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DEPARTMENT OF THE INTERIOR

ANNUAL REPORT

OF THE

TOPOGRAPHICAL SURVEYS BRANCH

1912-13

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1914

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REPORT

OF THE

SURVEYOR GENERAL OF DOMINION LANDS

1912-13

DEPARTMENT OF THE INTERIOR,
TOPOGRAPHICAL SURVEYS BRANCH,
OTTAWA, August 2, 1913.

The Deputy Minister of the Interior,
Ottawa.

SIR,—I have the honour to submit the following report of the Topographical Surveys Branch for the year ended March 31, 1913.

The surveys in northern Manitoba and the Peace River district were on a larger scale than before. Eighty-two parties were employed, eighty-one of whom were engaged for the whole season, and one for a short period only. The number of parties under daily pay was forty-four, of whom five were for the inspection of contract surveys, ten for the survey of base lines and initial meridians, one for levelling, one for latitude observations, one for triangulation, and the remaining twenty-six for subdivision, resurvey and miscellaneous work of various kinds. Thirty-seven parties were employed under contract on township subdivision.

The following table shows the distribution of parties by provinces:—

Parties.	In Man.	In Sask.	In Alta.	In B.C.	Partly in one Province and partly in another.	Total.
Paid by the day	4	6	16	8	10	44
Under contract	10	18	9	.....	.....	37
Parties engaged for a short time only	.....	.....	1	.....	.....	1
Totals	14	24	26	8	10	82

One hundred and fifty-two whole townships and ten fractional townships were completely subdivided and a partial subdivision was made in four hundred and seventy-five others. Twenty-two whole and two fractional townships were also completely resurveyed and in two hundred and two others portions of the township were resurveyed.

The following statement shows the average number of miles of survey for each party during the last four years:

1909	412 miles
1910	279 "
1911	280 "
1912	266 "

SURVEY OF BLOCK OUTLINES.

Ten surveyors were employed in establishing initial meridians and base lines, and another surveyor retraced the principal meridian. Five of these were located in Alberta, two in Saskatchewan, and three in Manitoba.

Mr. G. H. Herriot, D.L.S., produced the principal meridian north from the sixteenth to the eighteenth base line. This line crosses many bodies of water necessitating much triangulation. In six miles nine channels of Nelson river were crossed. During the summer supplies had to be transported by canoes or man packing, the boggy nature of the district preventing the use of horses.

Parts of the fifteenth, sixteenth and seventeenth base lines west of the principal meridian were run by Mr. O. Rolfson, D.L.S. His report has not yet been received as the field work will not be completed till the end of the present season.

The district through which Mr. E. W. Robinson, D.L.S., produced the second meridian being very wet, the line had to be surveyed in winter. Mr. Robinson has ceased operations, but has not had time yet to prepare his general report.

Mr. T. H. Plunkett, D.L.S., ran portions of the tenth, eleventh, twelfth, thirteenth and fourteenth base lines west of the principal meridian and part of the thirteenth west of the second meridian. The district crossed by these lines is low and very wet. Floating bogs are numerous and water channels scarce, the mossy surface hindering drainage. The slope of the country will, however, be sufficient for drainage when drainage channels are opened.

A portion of the third meridian, from the seventeenth to the eighteenth base line, was established by Mr. A. Saint Cyr, D.L.S. He also surveyed the eighteenth base line from the third to the fourth meridian. The country along the third meridian is so marshy that the roads had to be corduroyed or brushed to bear the weight of the loaded pack ponies. A great part of this boggy land is due to beaver dams which interfere with the natural flow of water. Along the eighteenth base line the land is higher. Stony patches are frequent, and watercourses and lakes are numerous. The surface is mostly wooded, but the timber is not of large size.

The most important industry of the district is fishing which is extensively carried on, the many large bodies of fresh water furnishing enormous quantities of fish from which the companies engaged in this trade obtain a large revenue.

The fourth meridian was produced northerly by Mr. J. B. McFarlane, D.L.S., from the northeast corner of township 105 to lake Athabaska. The country along this portion of the meridian is rolling, with sand hills and small lakes, but north of the twenty-eighth base line muskegs are numerous.

Mr. McFarlane also ran a portion of the twenty-fourth base line west of the fourth meridian.

Mr. Geo. McMillan, D.L.S., surveyed the twentieth base line across ranges 10 to 26 west of the fourth meridian. Good hay and water were found to be abundant. The district is well suited for ranching and access is easy, Athabaska river flowing directly north through it. The surface is densely wooded in Pelican mountains west of the Athabaska, but the timber is too small for milling.

Along the Athabaska there is a strip of dry land, but beyond this rim a muskeg, which had to be corduroyed to carry the pack ponies, extends westerly to the Pelican mountains. Beyond the muskeg, the ground is firm and the surface rolling and hilly.

The nineteenth base from range 5 west of the fourth meridian to the fifth meridian was surveyed by Mr. G. H. Blanchet, D.L.S. The country is similar to that along the base line immediately north which was surveyed by Mr. McMillan, except that the land east of the Athabaska has less muskeg.

Mr. A. H. Hawkins, D.L.S., ran the twenty-third base line from the fifth to the sixth meridian. Access to this work was obtained by sleighs as no summer roads are opened and no water routes are available. Supplies had to be brought in from Edmonton for the eastern portion of the work but for the western part supplies were taken down Peace river.

Forest fires raged during the survey of this line and the party had some narrow escapes.

Much time was lost on this line going around muskegs which could not be crossed, and progress was also retarded by extensive windfalls, the whole district having been overrun by fire.

The twentieth base line across ranges 18 to 26 and the twenty-third base line across ranges 1 to 8, west of the sixth meridian were run by Mr. J. R. Akins, D.L.S. He also resurveyed a portion of the sixth meridian. The twentieth base line crosses very rough and hilly country, and consequently the work proceeded slowly. This rendered levelling especially difficult, and although many long sights were taken across the deep valleys, trigonometric methods had to be used in many cases.

Along the twenty-third base line the whole country for one hundred miles north of Dunvegan was burnt over, lack of rain in the fall of 1912 being the cause. These forest fires, which in one case had to be fought for three days to save the horses and outfit, destroyed all the grass. The pack train had to travel fourteen miles from camp to secure horse feed when working along the sixth meridian, and when fifteeen miles of this line had been run, the work had to be abandoned as no feed was available.

These fires are a source of great danger to survey parties as caches of supplies are frequently destroyed, and unless additional supplies can be readily secured the work has to be abandoned.

INSPECTION OF CONTRACT SURVEYS.

A chief inspector and five inspectors were employed on the examination of surveys made under contract. The chief inspector was Mr. E. W. Hubbell, D.L.S., and the inspectors, Messrs. P. R. A. Bélanger, D.L.S., C. F. Miles, D.L.S., L. E. Fontaine, D.L.S., G. J. Lonergan, D.L.S., and W. J. Deans, D.L.S.

The work of the inspectors is now more difficult than when the contract surveys were located on prairie or level wooded land. Contracts at present comprise heavily wooded land intersected with marshes which render inspection slower. Access to the work is also a great obstacle and supplies have to be forwarded over roads which are sometimes in bad condition.

Accordingly the inspectors perform very little miscellaneous work and travelling parties consisting of a surveyor and an assistant, with the aid of local labour, have to be employed for such work.

This condition of affairs is likely to continue if surveys are to be kept ahead of settlement and railway construction.

Messrs. Bélanger and Deans inspected the contracts in Manitoba and eastern Saskatchewan, while Messrs. Fontaine, Lonergan and Miles examined the work in Alberta and western Saskatchewan.

BRITISH COLUMBIA SURVEYS.

Six surveyors were employed on work in the railway belt of British Columbia.

Mr. J. A. Calder, D.L.S., surveyed lands in the Thomson and Nicola valleys in the vicinity of Spence's Bridge, and also near Walhachin. The portions surveyed are well adapted for fruit raising, though irrigation is necessary to secure good results.

Mr. A. Lighthall, D.L.S., retraced the townsite of Langley, ran traverses and took levels at Woodhaven, and performed several miscellaneous subdivision surveys. He also surveyed the outlines of timber berths along the North Arm of Burrard Inlet, and Pitt lake.

Some subdivisions around Kamloops was done by Mr. C. H. Taggart, D.L.S. He also established a portion of the outline of the railway belt west of Adams lake. This outline is very rough and thickly wooded, the ground in places being covered with heavy windfall.

Mr. N. C. Stewart, D.L.S., carried on subdivision in the vicinity of Enderby, Golden and Moberly, and surveyed the townsite of Rogers Pass in township 27, range 25 west of the fifth meridian.

Subdivision surveys were made by Mr. P. Melhuish, D.L.S., in the vicinity of Keefers and Spuzzum. He also surveyed a timber berth at the latter place.

Mr. A. V. Chase, D.L.S., continued the examination of vacant lands in the Kamloops district.

TOWNSHIP SUBDIVISION SURVEYS.

Most of the subdivision surveys were performed under contract, but in some cases the surveys were made by daily paid surveyors, as the work was of such a nature that it could not be done at contract rates.

Mr. E. W. Berry, D.L.S., subdivided lands along the Hudson Bay railway near Le Pas, which were wanted for settlement.

Mr. P. B. Street, D.L.S., surveyed in the foot-hills in southeastern Alberta and Mr. E. S. Martindale, D.L.S., worked farther north in the foot-hills, about fifty miles southwest of Calgary.

Subdivision near the Yellowhead Pass was done by Mr. C. A. Grassie, D.L.S. The land subdivided lies along the line of the Canadian Northern railway within the Jasper Forest Park reserve.

In the Brazeau district, Mr. A. L. McNaughton, D.L.S., subdivided lands on which coal claims had been staked out.

Mr. L. Brenot, D.L.S., subdivided land on the upper Peace river in the vicinity of Hudson Hope and Fort St. John settlements.

The most isolated surveys were those of Mr. J. S. Galletly, D.L.S., in the Vermilion district, over 150 miles north of Peace River Crossing. Some first-class farming land in the valley of Peace river was subdivided and settlers who had been in the district for some time had the boundaries of their homesteads properly defined.

CORRECTION, RESTORATION AND MISCELLANEOUS SURVEYS.

Mr. A. G. Stuart, D.L.S., retraced about one hundred and seventy miles of the principal meridian north from the international boundary. This work was necessary to locate an error of 26·49 chains in township 35. It was found that the discrepancy was due to the use of incorrect chains by the surveyors who ran the line in 1871. Mr. Stuart did some traverse and correction surveys in Manitoba, and retracement and resurvey work was carried on in the same province by Mr. C. F. Aylsworth, D.L.S.

In Saskatchewan, Messrs. C. Rinfret, D.L.S., and S. L. Evans, D.L.S., worked on miscellaneous resurveys, retracement and restoration surveys, and the same class of work was attended to in Alberta by Messrs. J. A. Calder, D.L.S., and G. A. Cowper, D.L.S.

Four travelling parties were employed to carry on miscellaneous small surveys, and investigate errors, drying up of lakes, lost monuments, etc. Local assistance was procured when necessary, and as the work for the most part was in settled or partly settled districts no camp equipment was necessary. Messrs. G. A. Bennett, D.L.S., R. C. Purser, D.L.S., F. V. Seibert, D.L.S., and B. H. Segre, D.L.S., were the surveyors in charge of the travelling parties.

Mr. M. P. Bridgland, D.L.S., continued the triangulation work in the railway belt of British Columbia.

A base line about five miles long was measured at Salmon Arm with the invar wire base apparatus. Great precision was required in the measurement, the location of all triangulation stations in the vicinity being determined from this base. Mr. Bridgland also surveyed some villa lots at Banff.

The topographical survey in the Fiddle Creek district in the Jasper Forest Park Reserve was continued by Mr. H. Matheson, D.L.S. The principal work consisted in locating a road along Fiddle Creek canyon from the Grand Trunk Pacific station

to Miette Hot Springs, about eleven miles distant. The district is so rough and mountainous and the sides of the canyon so precipitous that much contour work was necessary and progress was slow.

Mr. J. A. Fletcher, D.L.S., took latitude observations on the second, third and fifth meridians and also in the railway belt of British Columbia.

The surveys of isolated settlements along Athabaska river were performed by Mr. E. A. Neville, D.L.S. Surveys were made at Chipewyan, Smith Landing and Fort Smith.

Mr. C. M. Walker, D.L.S., retraced two townships south of Medicine Hat. He also made a restoration survey of the townsite and villa lots at Banff, extended the townsite and surveyed the roads constructed around Banff, &c. The work at Banff was done for the Dominion Parks Branch, and was urgently required as applications for lots had to be withheld till the survey was completed.

Mr. L. F. Heuperman, D.L.S., who was employed for a short time only, did some subdivision northeast of Macleod.

STATEMENT OF MILEAGE SURVEYED.

The following is a comparison of the mileage surveyed each year since 1910:—

Nature of Survey.	April 1, 1910 to March 31, 1911.	April 1, 1911 to March 31, 1912.	April 1, 1912 to March 31, 1913.
	Miles.	Miles.	Miles.
Township outlines	2,376	2,041	2,718
Section lines	11,849	10,098	10,365
Traverse	2,758	2,577	3,509
Resurvey	906	2,317	2,586
Total for season	17,889	17,033	19,178
Number of parties	64	61	72
Average miles per party	279	280	266

The following tables show the mileage surveyed by the parties under daily pay and by the parties under contract:—

WORK OF PARTIES UNDER DAILY PAY.

Nature of Survey.	April 1, 1910 to March 31, 1911.	April 1, 1911 to March 31, 1912.	April 1, 1912 to March 31, 1913
	Miles.	Miles.	Miles.
Township outlines	1,178	992	1,619
Section lines	1,487	823	1,358
Traverse	462	498	992
Resurvey	835	2,237	2,538
Total for season	3,962	4,550	6,507
Number of parties	30	29	35
Average miles per party	132	157	186

WORK OF PARTIES UNDER CONTRACT.

Nature of Survey.	April 1, 1910 to March 31, 1911.	April 1, 1911 to March 31, 1912.	April 1, 1912 to March 31, 1913.
	Miles.	Miles.	Miles.
Township outlines	1,198	1,049	1,099
Section lines	10,362	9,275	9,007
Traverse	2,296	2,079	2,517
Resurvey	71	80	48
Total for season	13,927	12,483	12,671
Number of parties	34	32	37
Average miles per party	410	390	342

Owing to the nature of their work, ten parties are not included in the statement of mileage for the year ended March 31, 1913.

COST OF SURVEYS.

The following statement shows the average cost per mile of surveys executed by surveyors under daily pay and by surveyors under contract:—

—	Surveyed under daily pay.	Surveyed under contract.
Total mileage surveyed	6,507	12,671
Total cost	$455,780	$325,882
Average cost per mile	$70.05	$25 72

STANDARDS OF LENGTH.

The business of a land surveyor being to measure land, the first requisite of his profession is a correct measure. In the early days of Canada every surveyor upon receiving his commission was furnished by the Secretary of the Board of Examiners with a wooden yard by means of which he was directed to verify his chains. The length of a wooden rod is affected by moisture, heat and other causes; even if the length were correct, the accurate verification of a surveyor's chain by means of a yard requires elaborate apparatus and installations not usually at the disposal of surveyors. Such tests as a surveyor is able to make with a yard are suitable only for measurements of a rough character. One of my first acts in assuming the direction of Dominion Lands Surveys over thirty years ago, was to recommend the substitution of an adequate Standard of length, properly tested, in the place of the wooden yard Standard. I never ceased to urge the great importance and absolute necessity of this reform and I am glad to say that in a few months it will at last be accomplished. An account of the steps taken in endeavouring to obtain this reform is set forth in a resolution adopted by the Board of Examiners for D.L.S., on March 7, 1905. It is as follows:—

'Prior to 1886, the Dominion Lands Act required every Dominion Land surveyor to be in possession of a standard measure of length which was to be furnished to him

by the Department of Inland Revenue on payment of three dollars. The Standards, which were three feet pine rods, were of little or no use to surveyors and as no penalty was provided by the Act, few surveyors, if any, procured them.

In 1885, the Board of Examiners for Dominion Land Surveyors, impressed with the necessity of supplying adequate standard measures to surveyors, recommended that a line measure consisting of a 66 feet steel band be substituted in the place of the 3-feet wooden rod and that the Act be amended to provide that such measure should be furnished to surveyors by the Secretary of the Board, after being tested and stamped by the Department of Inland Revenue. A penalty of twelve months suspension was suggested for surveyors not complying with the law. These amendments were adopted by Parliament during the session of 1885-86 and assented to in June, 1886. The steel bands were immediately procured and the Board of Examiners deputed one of its members, Mr. W. F. King, to ascertain whether the Department of Inland Revenue had a suitable comparator for testing such measures. Mr. King interviewed Mr. Miall, Commissioner of Inland Revenue, who referred him to Mr. Johnstone, Chief Inspector of Weights and Measures. Mr. King was shown a comparator for testing end measures: he pointed out that it was not suitable for testing line measures such as those to be furnished to surveyors, and asked whether another comparator could be set up. Mr. Johnstone's reply was in the negative. It appeared from the conversation that the Department of Inland Revenue had for some time been asking a special building for their standards but so far had not succeeded in having it provided for in the estimates. When they obtained such a building, they would provide a suitable comparator, but not before. Thereupon, the board adopted a resolution recommending that the law be amended so as to place the testing of these measures under their own control and that the purchase of a comparator be authorized. Before acting upon this resolution, the Deputy Minister of the Interior communicated with the Commissioner of Inland Revenue and was informed that the comparator would be procured and set up.

Then followed a period of five years during which the Department of Inland Revenue alternately refused and agreed to set up the comparator until it was finally set up in 1891. The plans had been furnished by the Surveyor General, but the workmanship was so rough that the tests were never satisfactory. However, it was used for some years, one hundred and thirty-five measures being tested and issued to surveyors.

The uncertainty of measurements under these conditions may be illustrated by the experience of Mr. A. O. Wheeler, one of the surveyors of the Department of the Interior, with a 100 metres tape. A test of this tape was furnished by the manufacturers, Messrs. Keuffel & Esser, of New York, and another test by the United States Coast and Geodetic Survey. It was also compared with Mr. Wheeler's subsidiary standard which had been tested once by the Department of Inland Revenue and twice by this Board. The five comparisons reduced to the same temperature and tension show the tape to be too long as follows:—

Keuffel & Esser	0·194 inch.
U. S. Coast and Geodetic Survey	0·946 "
Department of Inland Revenue	1·498 "
Board of Examiners for D.L.S., first test	2·073 "
Board of Examiners for D.L.S., second test	2·307 "

The above figures show an uncertainty of over two inches in the length of this tape, equivalent to about three feet per mile. How unsatisfactory this is may be understood when it is stated that on well equipped comparators tests are now made with a precision equivalent to one or two-tenths of an inch per mile. Such an extreme precision is not required by surveyors in the ordinary practice of their

profession, but it is not unreasonable to ask for them an accuracy of one-fiftieth of an inch for a 66 feet tape, which is equivalent to 1·6 inches per mile.

A rough wooden shed for the comparator had been put up on an ordnance lot on Cliff street. The door was closed with a cheap padlock and light given through a few small windows without shutters. In 1902, or thereabouts, the place was entered by boys who broke the windows, stole seven steel bands and parts of the comparator, broke the thermometers and left everything in confusion. It was stated by the Deputy Minister of Inland Revenue that steps would be taken to replace the missing parts and to put the comparator in proper shape again but this has not yet been done and the tests of the measures furnished to surveyors since 1901 are not, in the opinion of the Board, sufficiently accurate to meet the requirements of the profession. The Surveyor General interviewed recently the Chief Inspector of Weights and Measures and was informed that the comparator on Cliff street would not be repaired but that one would be placed in a building to be erected for the standards. In the meantime, the measures would be tested on a mural standard back of the Langevin Block.

It is thus seen that we have come back to the point we started from nineteen years ago: the present Chief Inspector states, as Mr. Johnstone did then, that a suitable comparator will be provided when a building is erected for the standards. The Board is of the opinion that such a condition of affairs should not be allowed to continue any longer and that steps should be taken immediately to furnish to surveyors measures tested with sufficient precision for the purpose of their profession. After full consideration and discussion, the Board have come to the conclusion that the matter will not be properly attended to until it is placed under their control: therefore they recommend that the Dominion Lands Act be amended accordingly and that authority be granted for the establishment of a suitable comparator.'

The Chief Inspector of Weights and Measures was quite right in declining to test our measures until a building was provided. Control of the temperature is essential for proper tests; its variations must be extremely slow. This requires a substantial building; without it the accuracy of the tests would have been illusory.

The amendment to the law was not made until March, 1908, when the Dominion Lands Surveys Act was assented to. Section 35 of the Act directs the Surveyor General to furnish standard measures to surveyors and to make the necessary tests of these standards.

The next thing to be done was to erect a building for the installation of the testing apparatus so that the directions of the law could be carried out. Provision for the erection of the building was made in the estimates for several years in succession, but it was not commenced until last year. It is nearly finished. It is expected that the comparator will be installed and measures tested before the end of the summer.

The comparator was designed under the direction and according to the indications of Mr. Chas. Ed. Guillaume, Assistant Director of the International Bureau of Weights and Measures, who is probably the greatest living authority on questions relating to the measurement of lengths.

The plans were made and the apparatus constructed by the 'Société Genevoise pour la Construction d'Instruments de Physique et de Mécanique,' a firm which has made a specialty of this kind of apparatus. The comparator consists of a four metres invar rule divided into millimetres, borne by a carriage which moves upon rails opposite reference marks attached to concrete piers. The length, of the base, 32 metres, is sufficient for testing directly English measures up to 100 feet. The section of the invar rule, something like the letter 'h,' is entirely new. The apparatus, which is very elaborate, is provided with all the appliances necessary for convenience in handling and accuracy in results. The thanks of the Department are due to Mr. Guillaume for devising the apparatus, directing its construction, standardizing the invar rule, testing

and calculating tables of corrections for the precision thermometers, and helping us in many other ways.

The new subsidiary standard is a steel tape one-quarter inch wide, 0·012 inch thick and a little over 66 feet in length. On one side, at every ten links, one-tenth of a link is divided into hundredths and half hundredths. On the other side, at every ten feet up to 50 feet, one-tenth of a foot is divided into hundredths and fifths of a hundredth. The graduations, which are engraved, are very fine. A tension handle is provided for applying the tension of 10 pounds under which the tape is tested and certified. The standard is made by the Lufkin Rule Company of Canada; its perfection and accuracy are remarkable. The company fully realize the need and importance of an accurate standard; the surveying profession is indebted to them for their hearty co-operation in producing it.

ERRORS IN DOMINION LANDS SURVEYS.

Nearly nine-tenths of the existing surveys have been executed under my direction. When I took charge, the subdivision surveys had barely crossed the western limit of Manitoba; they now spread from Ontario to the Pacific Ocean and to township 110 in the north.

Under the provisions of the first Dominion Lands Act, a quarter section was held to contain 160 acres, whatever might be the actual contents. It followed that a section side was held to be one mile in length and was so returned by the surveyors. Four directions, no more, were admitted for section or township lines and entered by surveyors in their field notes, namely, north, south, east and west. Although the law has been changed on my recommendation and surveyors now return in their field notes what they actually find, the principle of the old law was sound. It makes absolutely no difference to a farmer whether his quarter section contains 159 or 161 acres; by calling the area 160 acres and the section side one mile, a great simplification was introduced in all land transactions. Evidently, the Surveyor General, Col. Dennis, when drafting the first Dominion Land Act, expected that the discrepancies of the survey could be kept within narrow limits and that is where the principle failed. As time went on, we heard of discrepancies sometimes exceeding a quarter of a mile, where, according to the surveyor's field notes, everything was perfectly regular. These errors appear to be spread all over Manitoba. In extending the surveys west of Manitoba, discrepancies of a like nature, although on a smaller scale, were met with; they were located and corrected by astronomical observations. Measuring on the earth by means of the stars is a roundabout way of finding distances and not a very accurate one, but it was the best we could do. We thus managed to keep errors within bounds outside of Manitoba. On reaching Peace river, we were a quarter of a mile out, but Peace river is a long way off; the error was corrected later. So far as we are able to judge, and with the exception of lower Peace river, which has not been checked, few if any township lines outside of Manitoba are more than 200 feet out of position.

For a long time, the condition of affairs in Manitoba was utterly incomprehensible; errors would crop up in the most unexpected places. In starting from a township corner and steering for the next one, we were never sure we would hit it or anywhere near it. The field notes of the old surveys, in which the entries were often purely conventional, afforded very little assistance. The trouble was attributed to the carelessnes and incompetence of early surveyors, but even if it had been understood it was too late for making corrections, because the lands had been taken up and their boundaries could not be changed. The climax happened when the principal meridian was produced northerly across lake Winnipeg for the purpose of surveying lands along the Hudson Bay railway; it was found by astronomical observations that township 35 was one-third of a mile too far north. A connected system of survey could not be carried out with errors of this magnitude in the short space of 35 townships,

and so it was decided to find out what the trouble was by going over the old lines right from the beginning. This was done last year by Mr. A. G. Stuart, who retraced the principal meridian from the international boundary to township 28. Then came the astonishing discovery that the errors were mostly due to the use of incorrect measures. The old surveyors were not to blame, but their chains were wrong and this was because the means of verification furnished to them were inadequate. The evidence is incontrovertible. Milner Hart, for instance, in laying out fifteen townships in 1871 made all his miles within a few links of the same length, which is proof of careful chaining, but every mile is 13 feet too long, which shows that his chain was two inches too long. It may be asked how it could possibly be so much in error. If Milner Hart verified his chain by stretching it on the prairie and measuring it with the wooden yard, furnished to him as a standard, the error on each yard length was less than one-tenth of an inch and is perhaps not more than was to be expected under the circumstances and with such rudimentary means of verification. If the measurements had been continued with that same chain up to Peace river or the Pacific Ocean, the township lines would have been nearly three miles out of position. If all the chains had been equally wrong, there would have been no difficulty; the townships and sections would have beeen square and all of equal size, without gap or overlap anywhere. But the chains were of various lengths; there were even some that were correct. The conditions can now be easily understood. Between the lines run westerly from the principal meridian and those run easterly from the second meridian upon which lengths are about correct, there is a gap which varies all the way from a few chains to 26 chains. This is not all; the base lines running east and west are affected by the same causes as the meridians and produce another set of discrepancies. The result of the whole is inextricable confusion.

It is unfortunate that surveyors were not at the outset provided with adequate means of verifying their chains. If lengths had been correctly measured, the land survey of the Dominion would have been the most perfect and remarkable one in the world.

CORRESPONDENCE.

The correspondence of this Branch consisted of:—

Letters received	12,598
Letters sent	16,600

ACCOUNTS.

Number of accounts dealt with	1,280
Amount of accounts	$976,436
Number of cheques forwarded	3,630

CHIEF DRAUGHTSMAN'S OFFICE.

(T. Shanks, Chief Draughtsman.)

In last year's report reference was made to the difficulty of carrying on efficient work owing to the many changes in the staff. As a result of these changes the unsatisfactory condition of the technical staff deserves serious consideration. It is becoming more difficult every year to have the office work attended to and it is falling in arrears. Only the immediate demands of the public can be dealt with under present conditions and even these cannot in many cases be given the consideration they deserve. It follows that much interesting and valuable information collected at great cost by the

surveyors cannot be made available for the public because we have not enough employees to compile it from the reports and field notes. Unless some measure of relief is obtained soon, the situation will get beyond control.

The technical staff consists of 93 men, or rather should consist of 93 men if all the vacancies were filled, but appointments cannot be made fast enough to fill the places of those who are leaving to do better elsewhere and who, as a rule are the most useful and efficient of our men. Many of the nominees of the Civil Service Commission after becoming aware of the prospects offered, decline the appointment. Others stay a few months and resign or are transferred to other offices.

In the past, applicants for positions in the office have been selected in most cases from graduates of recognized universities, preference being given to men who have some special training in mathemathics or engineering. During the last few years we have not been able to induce a sufficient number of competent men to accept employment or to remain in the service after appointment. Since May 1, 1910, the Civil Service Commission has been asked for the appointment of 65 technical clerks. From the applications received, 71 men with the required qualifications were selected but only 58 reported for duty and of these only 31 are at present on the staff. The fact that we are not able to obtain a sufficient number of qualified men to fill vacancies shows that the initial inducements are not attractive enough and the fact that we cannot retain the men who are appointed proves that the prospects for advancement are not to be compared with those of similar positions outside our service.

The duties of the technical staff may be classified under four heads, viz.:

1. Drafting instructions to surveyors.
2. Checking the work of surveyors, pointing out their mistakes and the corrections required.
3. Plotting the surveys and issuing the plans.
4. Furnishing technical information to other Departments and to the public.

The technical employee must be at least as well qualified as the surveyor if he is to tell the latter how his survey is to be made, but while the surveyor is paid at the rate of $3,100 to $4,500 a year, the technical employee is appointed at $1,200 a year with very remote prospects of ever advancing beyond $1,600. That the surveyors are not paid too much is proved by the fact that the number of recruits is barely sufficient for the needs of the service. In the West, the regular salary of a provincial land surveyor is fifteen dollars per day. The disproportion in the remuneration of the technical employee, who is fully as well qualified as the surveyor, explains why his services cannot be retained.

The consequences of this policy are manifold. A surveyor may be waiting for instructions because no competent employee is available to draft them; it would be cheaper to pay a fair salary to an employee than to keep a whole survey party idle. Or it may be that some plotting or other work has to be done before the survey can be proceeded with. If done by the surveyor while his party is waiting, it will cost $40 to $75 per day according to the size of the party. It could be done here by an employee at five or six dollars per day, but to have it done at $3.50 per day is a hopeless task. Many instances could be cited where the present organization of the staff is a cause of great waste, but the worst feature is the baneful effect on the surveys administration generally.

As the past decade has been one of remarkable activity in western Canada, the surveys of Dominion Lands have had to keep pace with the rapid progress in settlement and industrial development. To lay out the land ahead of the homesteader, the miner and the lumbermen has necessitated the organization of a large field staff, directed from the head office. This meant constantly keeping in touch with a widely scattered corps of surveyors, furnishing them with detailed instructions for their work and examining their field notes to see that the surveys were satisfactorily made.

The magnitude of this work may be judged from the following statement showing the number of surveyors employed for the past ten years:

Year.	On day pay.	On Contract.	Total number of surveyors employed.
1903	16	53	69
1904	25	57	82
1905	29	20	49
1906	35	29	64
1907	33	30	63
1908	39	31	70
1909	38	26	64
1910	39	34	73
1911	41	33	74
1912	44	37	81
Total	339	350	689
Average	34	35	69

While the extent of the surveys performed is a fair indication of the amount of office work for the year, it cannot be accepted as an accurate guide. The problems of survey work grow in complexity as settlement increases and this is true not only of field work but of questions of office administration. The surveys of early years were confined to township subdivision on the prairie. The instructions were simple, the work in many cases was performed by men who possessed neither lengthy experience nor special technical knowledge and the examination of the notes and plans was made with little attention to detail. As a result of settlement and the consequent increase in the value of the land, many things that were overlooked in the surveys of thirty and forty years ago have come to light. These frequently lead to disputes among settlers and to much investigation on the part of the Department and the errors are often difficult and sometimes impossible to correct. The law provides for corrections under certain conditions and an attempt is made to remove the trouble in every case where there is a possibility of this being done.

Among the other phases of work which have developed during recent years may be mentioned the growing demand for special settlement and townsite surveys, the greater attention given to exploratory and purely topographical work, the examination of railway and highway plans and the constantly increasing correspondence with the public and with surveyors in private or provincial practice who depend upon this office to furnish information about surveys already made. The research work entailed in collecting data from old survey records is not always easy and is further complicated by the fact that the offices of the Department are not accommodated in one building.

FIRST SECTION—SURVEY INSTRUCTIONS AND GENERAL INFORMATION.

(H. G. Barber, Chief of Section.)

The work performed in this section consists, in general, of the preparation of instructions for the surveyors in the field, the entering of all survey returns in the various registers, the issuing of all preliminary plans except for the townships in the railway belt of British Columbia, the issuing of the Annual Report of the Branch, and the answering of requests for information received from the general public and from other Branches and Departments.

Two hundred and fifty-five drafts of instructions were issued involving the preparation of 2,019 sketches and 253 maps and tracings.

One thousand four hundred and fifteen communications from settlers and others and inquiries from other Branches and Departments were dealt with. This necessitated the preparation of 1,830 sketches, 181 plans and tracings and 368 pages of field notes. Two thousand and twenty-nine copies of sketches were also made for the information of other Branches.

Preliminary plans were issued for 282 townships. Four copies of each are prepared, one copy being placed on file in this office, and one each being furnished to the Survey Records Branch, the Land Patents Branch, and the land agent in whose district the township lies.

Plans of 517 townships and 9 townsites and settlements were received from the lithographic office as well as 84 sectional maps and 153 miscellaneous plans.

The office registers show that there were received from the surveyors in the field, 1,372 progress sketches, 336 books of field notes for township surveys, 299 books and 254 plans for miscellaneous surveys, 210 timber reports, 176 statutory declarations, and returns for 73 magnetic observations and for 13 timber berths. General reports on their survey operations were received from forty surveyors.

Their examination being completed, 431 field books of township surveys and 52 books and 138 plans of miscellaneous surveys were placed on record.

The number of files received from the Correspondence Branch for use in the work of the office was 1,845.

The total number of draft letters and memoranda was 6,322.

The preparation of the new edition of the Manual of Instructions for the survey of Dominion Lands was completed during the year. It is now in the hands of the printers and it is expected that it will be issued shortly.

A new edition of the pamphlet entitled 'Description of the surveyed townships in the Peace River district in the provinces of Alberta and British Columbia' has just been prepared. It is now ready for the printers and is expected to be ready for distribution in a couple of months.

A new feature of the work of the section was the preparation of topographical maps of Banff, Woodhaven and Fitzhugh townsites and of Bankhead cemetery on which schemes of subdivision were laid down and from which working plans for the surveyor were prepared. This involved a large amount of work requiring the full time of three draughtsmen for about three and one-half months. The plans for Bankhead cemetery and the townsites of Woodhaven and Banff have beeen completed but considerable work still remains to be done in connection with Fitzhugh and the villa lot section of Banff.

For some time this staff has been labouring under the handicap of insufficient accommodation, it being necessary to have some of the members working in the rooms belonging to other sections. This, however, has been remedied. During the year the staff of Section IV removed to the Imperial Building and the room formerly used by them is now occupied by part of this staff.

The strength of the staff is 24 and in addition there is at present one temporary employee. This is four short of the required number and as a result a good deal of the less urgent work has had to be laid aside for the present.

SECOND SECTION—EXAMINATION OF RETURNS OF SURVEY.

(T. S. Nash, Chief of Section.)

In this section examination is made of the returns of survey of all Dominion Lands other than those in the railway belt in British Columbia and the necessary plans thereof are prepared.

As soon as a surveyor completes the survey of a township, or a portion thereof, he forwards a sketch showing the progress of his work. These sketches are examined to see that correct methods are being employed and that satisfactory results are being

obtained. 375 progress sketches from contractors, 532 from men employed by the day, and 195 from inspectors of contract surveys were examined making a total of 1,102 sketches.

A radical change was made in the method of dealing with water areas in the prairie provinces. Experience has shown that many of the bodies of water commonly called lakes are not permanent bodies of water since they vary largely in area according to the amount of annual precipitation. Surveyors define the position of the banks of these bodies of water to the best of their ability at the time of survey and in the preparation of the township plans areas have heretofore been calculated to the bank. This variable bank has not proved a satisfactory boundary and it has now been decided to use the information supplied by the surveyor to make a selection of certain aliquot parts of the quarter sections adjoining such bodies of water and to show the areas of these parts upon the plans for purposes of disposal. This change in method necessitated the changing of about two hundred plans that had been completed in the former way. It was also decided to omit the areas of patented lands from plans that are being amended. This involves considerable clerical work in obtaining the information to the date of confirmation of the plan. These changes have made it advisable to resume the practice of re-compiling plans that are out of print. 602 township plans were compiled, 290 of which were first edition plans.

Examination was made of 206 subdivision surveys, 142 miscellaneous and 274 township outlines. Compiled plans of 63 miscellaneous surveys, 4 settlements and 16 timber berths were made. Four hundred and thirteen memoranda on examination of survey returns were sent to surveyors and 446 replies were received and the necessary corrections made. The number of draft letters prepared was 1,520. Thirty-nine contract accounts were prepared and closed as the work was shown by the inspectors' report to be satisfactorily performed.

Considerable progress was made with the maps of the Yukon Territory mentioned in last year's report. Eight sheets in the vicinity of Dawson are now completed, three at Tantalus and a chain of five sheets between Whitehorse and the British Columbia boundary. Six group lot surveys and the survey of base lines on several tributaries of Stewart river were examined.

Requests for information from other Branches of the Department involved the writing of 288 memoranda, the preparation of 137 sketches, and the calculation of 940 areas. The field notes were examined and plans prepared for 16 timber berths comprising 27 blocks whose boundaries totalled 255 miles of survey and whose area is approximately 98 square miles. The returns of nine other timber berths were examined also.

The plans of road diversions submitted by the Provincial Governments have been examined to the number of 341. Of railways 155 plans of right-of-way were examined, the mileage of which is 2,891. As many of these plans were in duplicate, or triplicate, the gross mileage of plans examined was 4,418.

A great deal of time has been spent upon the preparation of a topographical map of the valley of Fiddle creek in Jasper Park, and on the preparation of a new plan of the town of Banff.

Five men resigned from the staff during the year and two were appointed, the staff now consisting of 23 permanent clerks and two temporary employees.

THIRD SECTION—DRAWING FOR REPRODUCTION.

(C. Engler, Chief of Section.)

The work of this section consists in drawing plans for reproduction by photography and lithography, and of any work of like nature arising in the other sections of this Branch of the Department. Wherever possible, letters and figures are made by means of type, a small press or small tripods being used for printing.

The output of plans of townships, the main work of the section, has been somewhat smaller than usual owing to changes made in the method of representing lake shores and areas bordering on lakes. Before a satisfactory way of showing these was arrived at several of the first methods had to be abandoned after considerable work had been done on plans in each case. Generally speaking, plans of resurveys and corrected editions of plans are more complicated than first editions and require more time and special attention to exceptional details, not going so regularly through the ordinary routine.

Below is a statement of work done.

Plans of townships prepared for printing	538
Plans of settlements, subdivisions, group lots, townsites, villa lots, &c	69
Plans to accompany Orders in Council	13
Miscellaneous plans, such as timber berths, sketch maps, profiles, drawing of apparatus, &c	117
Surveying instruments and steel tapes engraved with numbers or monograms	117
Certificates and Commissions engrossed for Board of Examiners for Dominion Land surveyors	56
Colored designs for pamphlet covers, sketches for half tones for pamphlets, &c	20
Total	930

No changes in the regular staff have occurred during the year, but five additional temporary clerks have been employed since January 1, 1913.

FOURTH SECTION—SURVEYS IN THE RAILWAY BELT—BRITISH COLUMBIA.

(E.L. Rowan-Legg, Chief of Section.)

The work of this section has been the preparing of preliminary plans from sketches sent in by surveyors, showing the progress of their work in the field, the examination of surveyors' field notes and plots, the compiling of township and other plans, the comparing of fair copies of township and other plans and replying to requests for various information.

The work done has been as follows:—

Preliminary plans compiled 52, and copies made 260; surveyors' field books of subdivision surveys examined 27, and plots 29; of mineral claims 3; of miscellaneous surveys 13; township plans compiled 98; townsite plans compiled 2; miscellaneous plans compiled 2; fair copies of compiled plans compared 131; various plots and sketches made 142; odd jobs and requests for various information dealt with 312; draft letters and memoranda written, 341.

A schedule of Indian reserves was prepared to accompany a report of the Minister of the Interior recommending that the lands included in these reserves be withdrawn from the operations of the regulations for the administration and disposal of lands within the railway belt. This recommendation was approved by Order in Council of January 25, 1913.

The staff of this section consisted of seven men, but this number was reduced by the removal of one to another section of the Branch, the absence of two for a considerable length of time on sick leave, and by the illness and death of Mr. Henry Lawe, D.L.S., who was a faithful and most industrious member of this staff for nine years. The staff, therefore, is reduced to five men.

As it was found that the building on Metcalfe street was too crowded, it was considered advisable that this staff should be moved to other quarters; it now occupies a room in the Imperial Building on Queen street.

FIFTH SECTION—MAPPING.

(J. Smith, Chief of Section.)

The work of the fifth section is principally on the sectional maps, compiling new ones as required and revising old ones, keeping them up to date as to new surveys, railways, post offices, &c., and also making other maps that require the work of expert draughtsmen.

Apart from the sectional maps, work, equivalent to the work of one man for 245 days, was done by this section on miscellaneous drawings to accompany reports of surveyors, and 28 days were spent in revising the map of the Peace River district.

On January 1, 1913, the staff of this section was increased by the transfer from the Sixth Section of four men whose principal work is the compiling of pamphlets descriptive of the newly surveyed districts of the western provinces. The pamphlets contain not only all the reports received from surveyors between July, 1911, and July, 1912, but also all the available information respecting the natural features and resources of the district.

All available information was collected and edited for the St. Ann, Saddle Lake, Shell River, Brule and Duck Mountain pamphlets which contain descriptions of one hundred and twenty-three townships each.

The staff of this section now numbers seventeen.

Illness and accidents caused loss of work during the year equivalent to the work of one man for 345 days, which is about 8½ per cent of the aggregate time of the staff.

SIXTH SECTION—SCIENTIFIC AND TOPOGRAPHICAL WORK.

(G. Blanchard Dodge, Chief of Section.)

The work performed in general in this section consists of issuing instructions for and plotting returns of levels on meridians and base lines, checking and reducing magnetic observations, calculating astronomical field tables, testing and adjusting survey instruments, and preparing and issuing the pamphlets containing surveyors' township reports, &c. The level work was in large part transferred in the early part of the year to the Calgary office of the Branch. The preparation of the pamphlets containing the surveyors' township reports was on December 31, 1912, transferred to the Fifth Section.

The number of magnetic declination returns received for the year ended March 31, 1913, is 1,278, making a total to date since 1908 of 4,114. Dip and total force observations for the year number 30, with a total of dip observations since 1908, of 144, and of total force observations 120. A statement of the observations for the past year is published with this report.

In Appendix No. 50 of the Annual Report of the Branch for 1911, on the determination of the magnetic declination, dip and total force in Western Canada, in Table No. 3, the logarithms of the total intensity are given instead of the natural values. The Table has been reprinted and accompanies the statement of the declination observations in the present report.

The computations of the triangulation in the railway belt of British Columbia are in hand. It is expected that full information for that portion extending from the Salmon Arm base to the Kootenay base will be available during the coming winter.

All the returns of azimuth observations for the year 1911 received during 1912 have been examined and checked and also the latitude observations of Mr. J. A.

Fletcher, D.L.S., taken during 1912. The astronomical field tables for the year have been computed.

The following reports of townships have been compiled from the surveyors' reports and sent to press from April 1, 1912, to December 31, 1912.

1. Reports on townships east and west of the Principal Meridian and west of the Second Meridian.
2. Reports on townships west of the Third Meridian.
3. Reports on towships west of the Fourth Meridian.
4. Reports on townships west of the Fifth and Sixth Meridians.
5. Reports on townships in the railway belt, B.C.

The work done at the Surveys Laboratory for the past year, includes the testing and adjusting of 10 block survey transits, 72 subdivision transits, 60 sidereal watches, and 62 subsidiary standards of length.

The number of letters received during the year was 450 while the number of letters sent was 1,203, besides 380 memoranda. Sixty letters of instructions to surveyors were prepared.

The staff at the close of the fiscal year consisted of seventeen permanent and three temporary clerks.

PHOTOGRAPHIC OFFICE.

(J. Woodruff, Chief Photographer.)

The work of the Chief Photographer shows a slight decrease in the total number of jobs for the year. This, however, is more than compensated for by the fact that there has been a very large increase in the number of Vandyke and blue prints made, and these are of much larger size than those of previous years.

A new Enlarging Camera is under construction capable of taking negatives up to 20 inches instead of 14 inches as in the present camera. This will facilitate bromide enlarging, and permit of much quicker and better work being done.

PHOTOGRAPHIC OFFICE.

(H. K. Carruthers, Process Photographer.)

While the negatives and photo-liths appear to be smaller in number this year than last, the fact must not be overlooked that we are now handling much larger plates An original which previously took four (4) 15 x 18 inch negatives is now made on a 24 x 32 inch plate, and the same procedure is followed in printing on zinc plates.

A new board of unique type has been placed on the copying camera. On the back is a frame made of steel angle iron with cross bars. By the adjusting of some twenty fine threaded screws, the whole surface of the board can be made perfectly flat.

Millimeter scales of brass have been added to the scaling rod making our reductions and enlargements more accurate.

A plate glass fifty inches square in a sliding frame hung from the steel rails above, keeps the copies in close contact with the board and is automatically held there, or released, by catches at the back.

BOARD OF EXAMINERS FOR DOMINION LAND SURVEYORS.

(F. D. Henderson, Secretary.)

The Board of Examiners held two meetings during the year. The first was a special meeting lasting from April 27 to June 1 (inclusive), 1912, during which examinations were held at Ottawa, Toronto, Calgary and Edmonton. The second was

the regular annual meeting which began February 10 ('the second Monday in the month of February' as provided in the D.L.S. Act, section 9) and lasted until March 27, 1913. Examinations were held at Ottawa, Kingston, Toronto, Winnipeg, Calgary and Edmonton. Two hundred and seventy-one candidates were examined.

Following are the names of the successful candidates:

PRELIMINARY EXAMINATION (56).

Albrecht, Eric W., Ottawa, Ont.
Alport, Frederic, Orillia, Ont.
Badgley, Leonard Amey, Canfield, Ont.
Ball, Alfred Nepean, Grenfell, Sask.
Batters, G. W. Stanley, Edmonton, Alta.
Beatty, Frank Weldon, Pembroke, Ont.
Beatty, William Benjamin, Sarnia, Ont.
Bedard, Henry J., Courtright, Ont.
Bick, Arthur Hardie, Ottawa, Ont.
Bromley, Robert Cecil, Winnipeg, Man.
Brown, Ernest Frank, Ottawa, Ont.
Brownlee, William Fisher, Macdonald's Corners, Ont.
Bruynseraede, Réné Paul P. A., Edmonton, Alta.
Calvin, Collamer Chipman, Kingston, Ont.
Carson, John Alton, Vancouver, B.C.
Child, Cyril George, Calgary, Alta.
Clendinning, James, Lurgan, Ireland.
Cuthbertson, William, Perth, Ont.
Daly, William Patrick, Ottawa, Ont.
Dawson, Wilfrid Laurier, Ottawa, Ont.
Douglas, Frederick William, Toronto, Ont.
Falls, Orville M., Toronto, Ont.
French, Merritt Henry, Calgary, Alta.
Gray, Blair, Komoka, Ont.
Hughes, Charles, Calgary, Alta.
Hunt, Septimus, Calgary, Alta.
Humphreys, Wilfrid, Winnipeg, Man.
Hyatt, Albert Edward, Revelstoke, B.C.
Knight, Sydney, Edmonton, Alta.
Lumb, William Ewart, Fort Stewart, Ont.
MacDonald, Leslie Stuart, Prince Edward Island.
Macdonald, Charles Alexander, Toronto, Ont.
Masson, Duncan Morrison, Toronto, Ont.
Matheson, Alexander, Armow, Ont.
Melrose, Thomas Montague, Coaticook, P.Q.
Mitchell, John Clarence, London, Ont.
Morse, Graham Parsons, Prince Albert, Sask.
McAndrew, Joseph Benedict, St. Catharines, Ont.
McNally, Henry Augustine, Westport, Ont.
Ney, Cecil Herman, Aurora, Ont.
O'Sullivan, J. F. Blake, Quebec, P.Q.
Petrie, Edward, Ottawa, Ont.
Raley, William Emsley, Lethbridge, Alta.
Rance, Charles Clarence, Toronto, Ont.
Robinson, William Earl, Beathton, Ont.
Robinson, Edward Keith, Kingston, Ont.
Ross, William Wrighton Eustache, Pembroke, Ont.
Seibert, Percy T., Southampton, Ont.
Scott, Buckton Arthur, Edmonton, Alta.
Teare, Frank, Toronto, Ont.
Thomas, Llewellyn Olding, Westmount, Que
Venny, Leonard Thomas, Brockville, Ont
Van Patter, Hugh Stanley, Aylmer, Ont.
Watson, Frederick Errol, Toronto, Ont.
Wilkinson, Robert Greenless, Regina, Sask.
Wilson, James Clarence, Wingham, Ont.

FINAL EXAMINATION (44).

Baird, Wilmot Johnston, Scarboro, Ont.
Beresford, Henry Edward, Portage la Prairie, Man.
Buchanan, John Alexander, Edmonton, Alta.
Calder, John Alexander, Ashcroft, B.C.
Cameron, Charles Scott, Regina, Sask.
Cameron, Maxwell George, Peterborough, Ont.
Cannell, Herbert William, Ottawa, Ont.
Carscallen, Hobart Rodney, Calgary, Alta.
Carthew, John Trewalla, Edmonton, Alta.
Coltham, George William, Aurora, Ont.
Cordukes, John Philip, Ottawa, Ont.
Coumans, Oliver Frank, Chepstow, Ont.
Donnelly, Cecil, Winnipeg, Man.
Elliott, George Reginald, Goderich, Ont.
Ellis, Douglas Stewart, Kingston, Ont.
Fletcher, William Arthur, Calgary, Alta.
Johnson, Hubert Colpoys, Ottawa, Ont.
Johnston, Charles Ernest, Toronto, Ont.
Johnston, James Homer, Cottam, Ont.
Lamb, Frederick Carlyle, Saskatoon, Sask.
Macdonald, George Alexander, Muirkirk, Ont.
Malcolm, William Lindsay, Guelph, Ont.
Milliken, John Bolton, Ottawa, Ont.
McArthur, Alexander Stanley, Toronto, Ont.
McDonald, Harold French, Winnipeg, Man.
McElhanney, Thomas Andrew, Vancouver, B.C.
McKay, Robert B., Vancouver, B.C.
McLellan, Roy Alexander, Harriston, Ont.
Nesham, Edward Williams, Ottawa, Ont.
Parry, Harry, Ottawa, Ont.
Pearson, Hugh Edward, Edmonton, Alta.
Pinder, George Zouch, Edmonton, Alta.
Pounder, John Allan, Ottawa, Ont.
Ratz, John Earl, Ottawa, Ont.
Reid, John, Winnipeg, Man.
Robertson, Edgar Doctor, Edmonton, Alta.
Segre, Beresford Henry, Toronto, Ont.
Seigner, William Adam, Toronto, Ont.
Vickers, Thomas Newell, Renwick, Ont.
von Edeskuty, Joseph Otto, Vancouver, B.C.
Wadlin, Lorenzo Norette, Ottawa, Ont.
Warrington, George Albert, Winnipeg, Man.
Waugh, Bruce Wallace, Berlin, Ont.
Weld, William Elfred, Ottawa, Ont.

The answer-papers of all candidates were sent to Ottawa as usual and the reading and valuation of these formed a large part of the work of the Board. At each meeting also a complete set of question papers was prepared to be held in readiness for the next examination.

Provincial surveyors writing under section 21 of the Act, are required to produce their provincial certificates, and other final candidates are required to produce affidavits of service under articles. All such evidence was examined and passed upon by the Board. Two minors who had presented themselves for final exmanination were admitted on the understanding that in case they were successful their commissions would not issue until they became of age and furnished affidavits in the regular form.

Several applications were received from college graduates asking to be admitted to the privileges of the shorter term of service under articles as provided for by section 22 of the Act. Favourable decisions were given in the following cases:—

(*a*) Graduates of the School of Mining, Kingston, in the Power Development Course.

(*b*) Graduates of the University of Alberta, who have taken certain courses in the Department of Applied Science.

(*c*) Graduates in Civil Engineering of Dalhousie University, Nova Scotia.

A form of Instructions to Presiding Examiners was drawn up and adopted. It is hoped by this means to secure uniformity in the method of dealing with candidates and in the manner of sending in the returns, and thus to facilitate the work of the Board.

Short forms for articles of apprenticeship and for transfer of articles were drawn up. These were afterwards passed by Order in Council and are now in use. They replace forms B and E in the Appendix to the Act.

Thirty-four commissions as Dominion Land surveyors were issued to those who had passed the final examination, and had furnished oaths of office and allegiance and bonds for the sum of one thousand dollars as required by section 25 of the Dominion Lands Surveys Act.

Every Dominion Land surveyor is required to be in possession of a subsidiary standard of length (D.L.S. Act, Section 35). The issue of the style of standard which has been in use for some years was discontinued in May, and a new model was adopted which, however, was not ready for distribution until October. It is a steel tape one-quarter of an inch wide and a little over 0·012 of an inch thick. It shows links on one side and feet on the other. The new standard weighs nearly one pound less than the old; it is also more accurate and more convenient for use. Forty-seven standards were issued during the year after having been carefully tested in the Surveys Laboratory. Forty-five of these went to Dominion Land surveyors and two to provincial surveyors. A list of Dominion Land surveyors who are in possession of standard measures, will be found in Appendix No. 10.

In February the office of the Secretary of the Board was removed from the Topographical Surveys Branch, Metcalfe street, to the Imperial Building, Queen street. A more commodious room was secured which will also serve for a Board Room. A type-writer clerk has also been appointed to assist with the work.

The correspondence of the Board was as follows:—

Letters received	1,656
Letters sent	781
Circular letters, pamphlets, notices, &c., sent	1,783

The following table shows the number who have tried the various examinations each year since 1900, and the number and percentage of successful candidates:—

FISCAL YEAR.	PRELIMINARY.			FINAL.			D. T. S.			TOTAL.		
	Tried.	Pas'd.	Per cent Pas'd.	Tried.	Pas'd.	Per cent Pas'd.	Tried.	Pas'd.	Per cent Pas'd.	Tried.	Pas'd.	Per cent Pas'd.
1899-00...	7	6	86	5	4	80	0	.....	.....	12	10	83
1900-01...	5	5	100	5	5	100	0	.....	.....	10	10	100
1901-02...	30	26	87	10	9	90	0	.....	.....	40	35	88
1902-03...	31	22	71	8	8	100	0	.....	.....	39	30	77
1903-04...	43	37	86	18	13	72	0	.....	.....	61	50	82
1904-05...	57	42	74	23	20	87	1	0	.....	81	62	77
1905-06...	36	25	70	27	19	70	4	.....	.....	67	44	66
1906-07...	20	15	75	20	15	75	1	0	.....	41	30	73
1907-08...	132	67	51	28	21	75	1	0	.....	161	88	55
1908-09...	224	88	39	52	27	52	3	1	33	279	116	42
1909-10...	289	97	34	72	37	51	1	0	.....	362	134	37
1910-11...	186	64	34	69	38	55	2	1	50	257	103	40
1911-12...	195	57	29	71	48	68	2	0	.....	268	105	39
1912-13...	187	56	30	83	44	53	1	0	.....	271	100	37

APPENDICES.

The following schedules and statements are appended:—

No. 1. Schedule of surveyors employed and work executed by them from April 1, 1912, to March 31, 1913.

No. 2. Schedule showing for each surveyor employed from April 1, 1912, to March 31, 1913, the number of miles surveyed of township section lines, township outlines, traverses of lakes and rivers and resurvey; also the cost of the same.

No. 3. List of lots in the Yukon Territory, surveys of which have been received from April 1, 1912, to March 31, 1913.

No. 4. List of miscellaneous surveys in the Yukon Territory, returns of which have been received from April 1, 1912, to March 31, 1913.

No. 5. Statement of work executed in the office of the chief draughtsman.

No. 6. List of new editions of sectional maps issued from April 1, 1912, to March 31, 1913.

No. 7. Statement of work executed in the photographic office from April 1, 1912, to March 31, 1913.

No. 8. Statement of work executed in the lithographic office from April 1, 1912, to March 31, 1913.

No. 9. List of Employees of the Topographical Surveys Branch at Ottawa, giving the name, classification, duties of office and salary of each.

No. 10. List of Dominion Land Surveyors who are in possession of standard measures.

Nos. 11 to 51. Reports of surveyors employed.

No. 52. Results of observations for magnetic declination.

MAPS AND PROFILES.

The following maps and profiles accompany this report:—

Map showing surveys to March 31, 1913.
Maps to accompany reports of surveyors.
Profiles of meridians and base lines.

I have the honour to be, Sir,
Your obedient servant,

E. DEVILLE,
Surveyor General.

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TOPOGRAPHICAL SURVEYS BRANCH

SCHEDULES AND STATEMENTS.

APPENDIX No. 1.

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913.

Surveyor.	Address.	Description of Work.
Akins, J. R..	Ottawa, Ont..	Survey of the twentieth base line across ranges 18 to 26, the twenty-third base line across ranges 1 to 8 and part of range 9, the twenty-second base line across ranges 5, 6 and part of 7 and the east outlines of townships 85 and 86, range 5, and part of township 85, range 6, west of the sixth meridian. Correction survey of the sixth meridian from the twenty-second to the twenty-third base line. Resurvey in townships 75, ranges 14 and 15, west of the fifth meridian, and of the north boundary of township 84, range 4, west of the sixth meridian.
Allison, C. B..	South Woodslee, Ont ..	Contract No. 13 of 1912. Subdivision of townships 34, 35 and 36, ranges 16 and 17, west of the principal meridian.
Aylsworth, C. F.. ..	Madoc, Ont..	Resurvey in township 18, range 1, east of the principal meridian, and in townships 22 and 23, range 5, west of the principal meridian. Retracement in townships 15, 16 and 25, range 6, and township 25, range 7, east of the principal meridian.
Belanger, P. R. A.. ..	Ottawa, Ont..	Inspection of contracts Nos. 2, 4, 5 and 6 of 1911, and Nos. 16, 17, 18 and 20 of 1912. Resurvey in township 8, range 12, west of the principal meridian. Traverse of Assiniboine river in townships 8, ranges 12 and 13, west of the principal meridian. Survey of timber berth No. 1920 in township 44, range 4, west of the second meridian. Retracement survey in townships 14, ranges 5 and 6, west of the principal meridian.
Bennett, G. A..	Calgary, Alta..	Subdivision in townships 45, ranges 10 and 11, west of the second meridian. Retracement survey in township 18, range, 2, townships 21, ranges 4 and 7, township 22, range 8, township 6, range 9, township 18, range 10, township 21, range 14, township 30, range 15, township 20, range 20, township 28, range 30, townships 18 and 19, range 31, townships 18, 19 and 31, range 32, and townships 18 and 19, range 33, west of the principal meridian; township 34, range 1, townships 14, ranges 4 and 5, township 26, range 6, and townships 15, ranges 25 and 26, west of the second meridian. Correction survey

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913—*Continued.*

Surveyor.	Address.	Description of Work.
		in townships 9 and 10, range 17, east of the principal meridian; township 21, range 2, township 33, range 19 and township 18, range 20, west of the principal meridian; township 6, range 14, west of the second meridian. Resurvey in township 1, range 14, east of the principal meridian. Traverse in townships 21, ranges 4 and 7, and township 30, range 15, west of the principal meridian; township 34, range 1, west of the second meridian. Investigation survey in townships 15 and 16, range 4, west of the principal meridian; townships 5, ranges 15 and 16, and townships 15, ranges 25 and 26, west of the second meridian.
Berry. E. W..	Seaforth, Ont..	Subdivision surveys along the Canadian Northern railway in townships 57 and 58, range 25, townships 55, 56, 57 and 58, range 26, townships 52 and 53, range 28, townships 51 and 52, range 29, and township 52, range 30, west of the principal meridian.
Blanchet, G. H..	Ottawa, Ont..	Survey of the nineteenth base line across ranges 6 to 26, west of the fourth meridian.
Bowman, E. P..	West Montrose, Ont..	Contract No. 7 of 1912. Subdivision of township 28, range 3, townships 28 and 29, range 4, and township 28, range 5, west of the principal meridian.
Brenot, L..	Ottawa, Ont..	Subdivision surveys in township 84, range 17, townships 83 and 84, ranges 18 and 19, and townships 81, ranges 25 and 26, west of the sixth meridian. Survey of the north outline of township 83, range 22, west of the sixth meridian, and the east outlines of townships 84, ranges 20, 22 and 23, west of the sixth meridian.
Bridgland, M. P..	Calgary, Alta	Survey of villa lots at Banff. Triangulation survey in the railway belt of British Columbia in the vicinity of Salmon Arm and Revelstoke.
Calder, J. A..	Lytton, B.C..	Subdivision in township 20, range 21, townships 20 and 21, range 22, townships 13, 14, 20 and 21, range 23, townships 16 and 17, ranges 24 and 25, townships 15, ranges 26, 27 and 28, and townships 15 and 16, range 29, west of the sixth meridian. Resurvey in township 21, range 22, townships 14 and 21, range 23, townships 16 and 17, range 25, and townships 15, ranges 26 and 27, west of the sixth meridian. Traverse in township 21, range 22, townships 13, 14 and 21, range 23, townships 16 and 17, range 24, townships 16, 17 and 19, range 25, townships 15, ranges 26, 27 and 28, and townships 15 and 16, range 29, west of the sixth meridian.
Campbell, A. S..	Kingston, Ont..	Resurvey of township 53, range 19, and township 49, range 20, west of the fourth meridian. Retracement survey in township 53, range 21, west of the fourth meridian. Resurvey in Lake St. Ann settlement in townships 54, ranges 3 and 4, west of the fifth meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913—*Continued.*

Surveyor.	Address.	Description of Work.
Chase, A. V..	Orillia, Ont..	Examination of lands in the Kamloops district of the railway belt, British Columbia, for the purpose of classification into fruit land, farming land, grazing land, timber land and worthless land.
Christie, W..	Prince Albert, Sask....	Contract No. 20 of 1912. Subdivision of townships 56 and 57, range 6, township 57, range 7, and parts of township 58, range 6, and township 56, range 7, west of the third meridian.
Cowper, G. C..	Welland, Ont..	Subdivision survey in townships 17 and 18, range 3, township 17, range 4, and townships 21 and 22, range 10, west of the fourth meridian. Retracement survey in townships 17, 18 and 19, range 3, township 19, range 4, and township 53, range 27, west of the fourth meridian. Resurvey in township 17, range 4, townships 21 and 22, range 10, and township 10, range 12, west of the fourth meridian. Traverse in township 60, range 1, and townships 64, ranges 4, 10 and 12, west of the fourth meridian. Investigation in townships 40 and 44, range 5, township 35, range 14, and townships 51, ranges 17 and 26, west of the fourth meridian.
Cumming, A. L..	Edmonton, Alta..	Contract No. 31 of 1912. Subdivision of townships 62 and 63, range 21, and townships 61, 62 and 63, range 22, west of the third meridian.
Davies, T. A..	Edmonton, Alta..	Contract No. 34 of 1912. Subdivision of townships 69 and the south two-thirds of townships 70, ranges 10, 11 and 12, and the south two-thirds of township 70, range 13, west of the fourth meridian.
Day, H. S..	Edmonton, Alta..	Contract No. 16 of 1912. Subdivision of townships 52, ranges 16 and 17, and townships 52 and 53, range 18, west of the second meridian.
Deans, W. J..	Brandon, Man..	Inspection of contracts No. 24 of 1908, No. 19 of 1909, Nos. 1, 7 and 11 of 1911, and Nos. 5, 6, 7, 8, 9, 10, 11 and 12 of 1912. Retracement survey in township 49, range 9, townships 50 and 51, range 12, and township 51, range 13, west of the third meridian. Traverse of Brereton lake in townships 10 and 11, ranges 14 and 15, east of the principal meridian. Survey of timber berth No. 1903 in townships 7 and 8, range 16, and township 8, range 17, east of the principal meridian.
Evans, S. L..	Corinth, Ont..	Subdivision in township 19, range 4, west of the fifth meridian. Survey of part of the east outline of township 20, range 6, west of the fifth meridian. Resurvey in township 13, range 14, west of the third meridian. Retracement survey in townships 6, ranges 24, 25, 26 and 27, township 7, range 28, and township 8, range 22, west of the third meridian. Traverse of Oldman river in townships 9, ranges 25 and 26, west of the fourth meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913—*Continued.*

Surveyor.	Address.	Description of Work.
Fairchild, C. C.	Edmonton, Alta.	Contract No. 36 of 1912. Subdivision of townships 63 and 64, ranges 5 and 6, west of the fifth meridian.
Fawcett, A.	Gravenhurst, Ont.	Contract No. 11 of 1912. Subdivision of township 23, range 12, townships 23, 30, 31, 32 and 33, range 13, and the portions of townships 30 and 31, range 12, west of lake Manitoba, west of the principal meridian.
Fletcher, J. A.	Ottawa, Ont.	Latitude observations on the second meridian in township 61, on the third meridian in township 57, on the fifth meridian at triangulation station I near Calgary, on the sixth meridian in township 48, at the north end of the base line on Salmon Arm, and on Sugarloaf mountain.
Fontaine, L. E.	Lévis, Que.	Inspection of contracts Nos. 25, 26 and 28 of 1911, and Nos. 1, 2, 3 and 4 of 1912.
Francis, J.	Portage la Prairie, Man.	Contract No. 5 of 1912. Subdivision of township 21, range 11, townships 21 and 22, ranges 12 and 13, west of the principal meridian. Resurvey in township 14, range 7, west of the principal meridian.
Galletly, J. S.	Brooklin, Ont.	Subdivision in township 73, range 6, townships 108 and 109, ranges 12, 13 and 14, townships 107 and 109, range 15, township 109, range 16, townships 83 and 84, range 21, west of the fifth meridian. Survey of the east outlines of townships 108, ranges 15 and 16, west of the fifth meridian. Miscellaneous lot surveys at Peace River Crossing.
Gibbon, J.	Vancouver, B.C.	Contract No. 8 of 1912. Subdivision of township 29 and part of township 30, range 5, and townships 28 and 29, range 6, west of the principal meridian.
Grassie, C. A.	Medicine Hat, Alta.	Subdivision in townships 49 and 50, range 27, and townships 48 and 49, range 28, west of the fifth meridian; townships 45, 47, 48 and 49, range 1, and townships 45, ranges 2, 3 and 4, west of the sixth meridian. Traverse on Snaring and Athabaska rivers in township 46, range 1, west of the sixth meridian.
Hawkins, A. H.	Listowel, Ont.	Survey of the twenty-third base line from the fifth to the sixth meridian, and of the sixth meridian through townships 89 and 90.
Herriot, G. H.	Ottawa, Ont.	Survey of the principal meridian from the sixteenth base line to the northeast corner of section 24, township 72.
Heuperman, L. F.	Calgary, Alta.	Subdivision in township 11, range 30, west of the fourth meridian.
Jackson, J. E.	Hamilton, Ont.	Contract No. 9 of 1912. Subdivision of townships 30, 31 and 32, range 6, townships 30 and 31, range 7, and part of township 30, range 8, west of the principal meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913—*Continued.*

Surveyor.	Address.	Description of Work.
Lighthall, A..	Vancouver, B.C..	Subdivision in townships 4 and 5, range 27, and township 4, range 28, west of the sixth meridian, townships 6, ranges 5, 6 and 7, west of the seventh meridian. Resurvey in township 5, range 26, west of the sixth meridian; townships 19 and 41, east of the coast meridian. Traverse in townships 4 and 5, range 26, and townships 4, ranges 27 and 28, west of the sixth meridian; townships 6, ranges 5 and 7, west of the seventh meridian; townships 11, 12 and 19, east of the coast meridian. Survey of timber berth No. 554 in township 3, range 25, and townships 3, 4 and 5, range 26, west of the sixth meridian; timber berth No. 555 in township 6, range 7, west of the seventh meridian; timber berth No. 557 in township 6, range 5, west of the seventh meridian.
Lonergan, G. J..	Buckingham, Que.. ..	Inspection of contracts Nos. 22, 25 and 26 of 1910, Nos. 20 and 28 of 1911, and Nos. 34, 35 and 36 of 1912. Resurvey in township 53, range 25, west of the third meridian; townships 63 and 64, ranges 3, 4, 5, 6, 7, 8, 9 and 10, west of the fourth meridian. Traverse in township 63, range 18, west of the fourth meridian. Survey of timber berth No. 1914 in township 42, range 6, west of the fifth meridian.
Loucks, R. W. E.. ..	Saskatoon, Sask..	Contract No. 21 of 1912. Subdivision of township 54, range 9, and townships 53 and 54, ranges 10 and 11, west of the third meridian. Survey of the east outlines of townships 55 and 56, range 10, and township 55, range 11, west of the third meridian.
MacLennan, A. L.. ..	Toronto, Ont..	Contract No. 15 of 1912. Subdivision of township 49 and the south two-thirds of township 50, range 9, townships 49 and 50, range 10, west of the second meridian. Survey of the east outlines of townships 51 and 52, range 10, west of the second meridian.
Martindale, E. S.. ..	Kingsmill, Ont..	Subdivision in townships 16 and 17, range 5, townships 17 and 18, range 6, township 18, range 7, township 19, range 8, and township 20, range 9, west of the fifth meridian. Retracement survey in townships 6, ranges 1 and 2, west of the fourth meridian. Subdivision of villa lots at Elkwater lake in township 8, range 3, west of the fourth meridian.
Martyn, O. W..	Regina, Sask..	Contract No. 17 of 1912. Subdivision of townships 52 and 53, ranges 19 and 20, west of the second meridian.
Matheson, H..	Ottawa, Ont..	Topographical surveys on the east slope of the valley of Fiddle creek in the Jasper Forest Park reserve in western Alberta. Subdivision in townships 48, 49 and 50, range 16, and township 48, range 17, west of the fifth meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913—*Continued.*

Surveyor.	Address.	Description of Work.
Melhuish, P.	Vancouver, B.C.	Subdivision in township 8, range 25, townships 7, 8, 10 and 11, range 26, and township 12, range 27, west of the sixth meridian. Resurvey in townships 8, 10, 11 and 12, range 26, west of the sixth meridian. Traverse in township 8, range 25, townships 7, 8, 9, 10, 11 and 12, range 26, and townships 8 and 9, range 27, west of the sixth meridian. Survey of timber berth No. 552 in township 8, range 26, and townships 8 and 9, range 27, west of the sixth meridian.
Miles, C. F.	Toronto, Ont.	Inspection of contracts No. 14 of 1910, Nos. 14 and 33 of 1911, Nos. 21, 22, 24, 25, 29 and 30 of 1912. Retracement survey in township 63, range 1, west of the fourth meridian. Traverse in township 58, range 21, west of the third meridian. Survey of Green Lake settlement in townships 61, ranges 12 and 13, west of the third meridian.
Molloy, J.	Winnipeg, Man.	Contract No. 1 of 1911. Subdivision of townships 12, ranges 13, 14, 15 and 16, and townships 11, ranges 15 and 16, east of the principal meridian.
Montgomery, R. H.	Prince Albert, Sask.	Contract No. 19 of 1912. Subdivision of townships 55 and 56, range 4, and townships 54, 55 and 56, range 5, west of the third meridian.
Morrier, J. E.	Prince Albert, Sask.	Contract No. 18 of 1912. Subdivision of townships 56, ranges 1, 2 and 3, the east halves of townships 54 and 55, range 1, and the north two-thirds of township 55, range 3, west of the third meridian.
McEwen, D. F.	Edmonton, Alta.	Contract No. 30 of 1912. Subdivision of township 63, range 19, townships 61, 62 and 63, range 20, township 61, range 21, west of the third meridian. Survey of the east outlines of townships 64, ranges 20 and 21, west of the third meridian.
McFarlane, J. B.	Toronto, Ont.	Production of the fourth meridian from the northeast corner of township 105 to the quarter section post on the east boundary of section 12, township 115, and the twenty-fourth base line across range 5 and part of range 6, west of the fourth meridian.
McFarlane, W. G.	Peace River Crossing, Alta.	Contract No. 1 of 1912. Subdivision of township 75 and the north two-thirds of townships 74, ranges 6, 7, 8 and 9, the south two-thirds of township 70, range 11, township 73 and the south two-thirds of township 74, range 12, west of the sixth meridian. Survey of the east outlines of townships 76, ranges 7, 8, 9 and 10, west of the sixth meridian.
McGrandle, H.	Wetaskiwin, Alta.	Contract No. 37 of 1912. Subdivision of township 52, range 25, and parts of townships 49 and 50, range 24, and township 50, range 25, west of the fifth meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913—*Continued.*

Surveyor.	Address.	Description of Work.
McMillan, Geo..	Finch, Ont..	Survey of the twentieth base line across ranges 10 to 26, west of the fourth meridian.
McNaughton, A. L....	Cornwall, Ont..	Subdivision survey in townships 46 and 47, range 19, township 47, range 20, townships 47 and 48, range 22, and townships 46 and 47, range 23, west of the fifth meridian. Mounding in townships 48, ranges 20 and 21, west of the fifth meridian.
Neelands, R..	Hamiota, Man..	Contract No. 6 of 1912. Subdivision of township 29, range 1, townships 28 and 29, range 2, and township 29, range 3, west of the principal meridian. Survey of timber berth No. 1877 in townships 24 and 25, range 4, and township 25, range 5, east of the principal meridian.
Neville, E. A..	Ruthven, Ont..	Settlement surveys at Chipewyan, Smith Landing and Fort Smith.
Palmer, P. E..	Dorchester, N.B..	Contract No. 12 of 1912. Subdivision of townships 32 and 33, range 14, township 33, range 15, and the south two-thirds of townships 34, ranges 14 and 15, west of the principal meridian.
Pierce, J. W..	Ottawa, Ont..	Contract No. 25 of 1912. Subdivision of township 56, range 15, townships 55, 56, 57, 58, and the north third of township 54, range 16, west of the third meridian.
Plunkett, T. H..	Meaford, Ont..	Production of the tenth base line across ranges 6 to 14 and parts of ranges 5 and 15, the eleventh base line across ranges 16 to 24 and part of range 25, the twelfth base line across ranges 17 to 24 and part of range 16, the thirteenth base line across ranges 28 to 32, and the fourteenth base line across ranges 28 to 31, west of the principal meridian. Also the thirteenth base line across ranges 1 to 4, west of the second meridian. Survey of the east outlines of townships 34, 35 and 36, ranges 8 and 15, west of the principal meridian. Subdivision in township 33, range 15, west of the principal meridian.
Proudfoot, H. B.. ..	Saskatoon, Sask..	Contract No. 23 of 1912. Subdivision of township 56, range 12, and townships 53, 54, 55 and 56, range 13, west of the third meridian.
Purser, R. C..	Windsor, Ont..	Subdivision in township 32, range 10, west of the third meridian. Resurvey in township 46, range 19, and township 43, range 28, west of the second meridian; township 36, range 19, west of the third meridian. Correction survey in township 38, range 19, west of the second meridian. Retracement surveys in township 47, range 19, and township 46, range 20, west of the second meridian; township 39, range 1, township 34, range 3, township 49, range 5, township 47, range 16, townships 53 and 54, range 22, township 54, range 23, and township 53,

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913—*Continued.*

Surveyor.	Address.	Description of Work.
		range 26, west of the third meridian. Traverse in townships 33 and 49, range 6, township 48, range 15, township 53, range 22, and township 54, range 23, west of the third meridian. Investigation and restoration survey in townships 37 and 38, range 26, west of the third meridian; township 60, range 25, and township 50, range 28, west of the fourth meridian.
Ransom, J. F..	Toronto, Ont..	Contract No. 14 of 1912. Subdivision of township 52, range 7, and townships 50 and 51, range 8, west of the second meridian. Survey of the east outline of township 52, range 8, and the north boundary of township 51, range 7, west of the second meridian.
Rinfret, C..	Montreal, Que..	Resurvey in townships 12 and 13, range 28, and townships 13 and 14, range 29, west of the second meridian. Correction survey in township 14, range 30, west of the second meridian; townships 14, ranges 1 and 10 west of the third meridian. Restoration survey in townships 14 and 15, ranges 23 and 24, and townships 15, ranges 25 and 26, west of the third meridian. Retracement survey in townships 13 and 14, ranges 23 and 24, township 13, range 25, and township 14, range 26, west of the second meridian; townships 12, 13 and 14, range 1, and townships 13 and 14, range 2, west of the third meridian. Investigation in townships 34, ranges 14 and 16, townships 32 and 35, range 17, and townships 32 and 33, range 18, west of the second meridian. Traverse in township 34, range 16, townships 32, ranges 17 and 18, townships 12, 13 and 14, range 28, townships 13 and 14, range 29, and township 14, range 30, west of the second meridian; townships 14 and 15, range 24, west of the third meridian.
Robinson, E. W..	Ottawa, Ont..	Production of the second meridian from the northeast corner of section 1, township 68 to the northeast corner of township 83. Mounding along second meridian from northeast corner of townships 62 to the northeast corner of section 1, township 68.
Robinson, W. A..	Winnipeg, Man..	Contract No 24 of 1912. Subdivision of townships 54, 55 and 56, range 14, and townships 54 and 55, range 15, west of the third meridian.
Rolfson, O..	Walkerville, Ont... ...	Survey of the fifteenth base line across ranges 1 to 3 and part of range 4, the sixteenth base line across ranges 1 to 25, and the seventeenth base line across ranges 1 to 5, west of the principal meridian.
Roy, J. E..	Quebec, Que..	Contract No. 22 of 1912. Subdivision of townships 55 and 56, range 11, and townships 53, 54 and 55, range 12, west of the third meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913—*Continued.*

Surveyor.	Address.	Description of Work.
Saint Cyr, A..	Ottawa, Ont..	Survey of the third meridian from the seventeenth to the eighteenth base line and of the eighteenth base line from the third to the fourth meridian.
Segré, B. H..	Davidson, Sask..	Subdivision in townships 18, ranges 29 and 30, west of the second meridian. Restoration survey in township 28, range 18, and township 27, range 19, west of the second meridian; township 46, range 3, west of the third meridian. Resurvey in township 26, range 2, west of the second meridian; township 25, range 3, west of the third meridian. Correction survey in townships 23, 24 and 28, range 27, west of the second meridian; township 16, range 1, and township 18, range 17, west of the third meridian. Retracement survey in townships 30 and 31, ranges 26 and 27, and townships 16, ranges 29 and 30, west of the second meridian.
Seibert, F. V..	Rush Lake, Sask..	Subdivision in township 7, range 30, west of the second meridian; township 7, range 1, and townships 16 and 17, ranges 10 and 11, west of the third meridian. Resurvey in township 11, range 12, and township 16, range 13, west of the third meridian; townships 2 and 3, range 15, west of the fourth meridian. Correction survey in township 24, range 25, west of the second meridian; township 26, ranges 13 and 20, west of the third meridian; township 38, range 11, township 24, range 12, townships 26, 27 and 43, range 14, and townships 26 and 27, range 15, west of the fourth meridian. Retracement survey in township 27, range 14, west of the second meridian; townships 19 and 20, range 15, and townships 17 and 18, range 17, west of the third meridian. Restoration survey in townships 2 and 3, range 14, west of the fourth meridian. Traverse in township 26, range 7, and townships 16, ranges 16, 17 and 21, west of the third meridian; township 8, range 3, township 38, range 11, and townships 48 and 49, ranges 22 and 23, west of the fourth meridian; township 8, range 5, west of the fifth meridian. Contour survey at Elkwater lake in township 8, range 3, west of the fourth meridian.
Soars, H. M. R..	Edmonton, Alta..	Contract No. 4 of 1912. Subdivision of townships 69, 70 and 71, ranges 22 and 24, townships 69 and 70, ranges 23 and 25, and the south two-thirds of township 71, range 23, west of the fifth meridian. Survey of the east outlines of townships 72, ranges 22, 23, 24 and 25, and townships 71 and 72, range 26, west of the fifth meridian.
Starkey, S. M..	Cody's, N.B..	Contract No. 26 of 1912. Subdivision of townships 59, 60, 61 and 62, range 16, and township 61, range 17, west of the third meridian.

APPENDIX No. 1—*Contiuned.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913—*Continued.*

Surveyor.	Address.	Description of Work.
Steele, I. J..	Ottawa, Ont..	Contract No. 32 of 1912. Subdivision of townships 61, 62 and 63, range 23, townships 63, 64 and the north third of township 62, range 24, west of the third meridian. Survey of the east outline of township 64, range 23, west of the third meridian.
Stewart, A. G..	Edmonton, Alta..	Contract No. 3 of 1912. Subdivision of township 81, range 18, the south two-thirds of township 82 and part of township 81, range 19, townships 82 and 83, range 20, townships 84, ranges 22, 23, 24, 25 and 26, west of the fifth meridian; townships 80, ranges 1 and 2, west of the sixth meridian. Survey of the east outlines of township 84, range 20, and township 81, range 21, west of the fifth meridian.
Stewart, N. C..	Ottawa, Ont..	Subdivision in townships 28, ranges 17 and 18, townships 28 and 29, ranges 22 and 23, township 31, range 25, and townships 31 and 32, range 26, west of the fifth meridian; townships 18 and 19, range 7, townships 18 and 20, range 8, township 19, range 9, and townships 17, 18 and 19, range 10, west of the sixth meridian. Resurvey in townships 28, ranges 17 and 18, townships 28 and 29, ranges 22 and 23, and townships 27, ranges 25 and 26, west of the fifth meridian; townships 18, ranges 7 and 8, townships 18, 19 and 20, range 9, and township 17, range 10, west of the sixth meridian. Traverse in townships 28, ranges 17 and 18, townships 27 and 28, range 22, townships 28 and 29, range 23, townships 27 and 31, range 25, and townships 27, 31 and 32, range 26, west of the fifth meridian; township 18, range 7, and township 17, range 10, west of the sixth meridian.
Stewart, W. M..	Saskatoon, Sask..	Contract No. 28 of 1912. Subdivision of townships 63 and 64, range 16, and townships 62, 63 and 64, range 17, west of the third meridian.
Stock, J. J..	Ottawa, Ont..	Contract No. 35 of 1912. Subdivision of townships 64 and 65, range 3, and townships 63 and 64, range 4, west of the fifth meridian.
Street, P. B..	Toronto, Ont..	Subdivision in townships 11 and 12, range 2, townships 10, 11 and 12, range 3, townships 10 and 11, range 4, and townships 10, 11, 12 and 13, range 5, west of the fifth meridian. Retracement survey in townships 5, ranges 17 and 18, and township 2, range 19, west of the fourth meridian.
Stuart, A. G..	Buckingham, Que.. ..	Retracement of the principal meridian from the international boundary to the eighth base line. Resurvey of township 21, range 4, west of the principal meridian. Correction survey in townships 31, ranges 8 and 9, west of the principal meridian. Traverse of Swan lake in townships 21, ranges 5 and 6, west of the principal meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1912, to March 31, 1913—*Continued.*

Surveyor.	Address.	Description of Work.
Taggart, C. H..	Ottawa, Ont..	Subdivision in township 21, range 12, townships 21 and 25, range 13, townships 23, 24 and 25, range 14, townships 20, 21, 22, 23 and 24, range 15, townships 22 and 23, range 16, townships 17, 21 and 22, range 17, and township 18, range 18, west of the sixth meridian. Resurvey in township 21, range 13, townships 24, ranges 14 and 15, township 22, range 16, and townships 17 and 21, range 17, west of the sixth meridian. Traverse in townships 24 and 25, range 14, townships 22 and 24, range 15, township 22, range 16, and townships 17 and 21, range 17, west of the principal meridian.
Taylor, W. E..	Owen Sound, Ont.. ..	Contract No. 10 of 1912. Subdivision of townships 29, 30, 31 and 32, range 11, township 32, range 12, and the portions of townships 30 and 31, range 12, east of lake Manitoba, west of the principal meridian.
Tipper, G. A..	Brantford, Ont..	Contract No. 2 of 1912. Subdivision of town ships 84 and 85 and the south two-thirds of township 82, range 2, townships 82, 83, 84 and 85, range 3, and townships 81, 82, 83 and 84, range 4, west of the sixth meridian.
Tremblay, A. J..	Edmonton, Alta..	Contract No. 33 of 1912. Subdivision of township 88 and the south two-thirds of township 89, range 8, townships 88, 89 and part of township 90, range 9, and township 88 and the south two-thirds of township 89, range 10, west of the fourth meridian.
Waddell, W. H..	Edmonton, Alta..	Contract No. 29 of 1912. Subdivision of townships 61, 62 and 63, range 18, townships 61 and 62, range 19, west of the third meridian. Survey of the east outlines of townships 64, ranges 18 and 19, west of the third meridian.
Walker, C. M..	Guelph, Ont..	Retracement survey of townships 1 and 2, range 6, west of the fourth meridian. Survey of cemetery and villa lots at Banff.
Wallace, J. N..	Calgary, Alta..	Levelling along Canadian Northern railway from Hudson Bay Junction to Islay, and also from Edmonton to Athabaska Landing and westerly along Athabaska river.

APPENDIX No. 2.

SCHEDULE showing for each surveyor employed from April 1, 1912, to March 31, 1913, the number of miles surveyed of township section lines, township outlines, traverses of lakes and rivers and resurvey, also the cost of the same.

Surveyor.	Miles of section.	Miles of outline.	Miles of traverse.	Miles of resurvey.	Total mileage.	Total cost.	Cost per mile.	Day work or contract.
						$	$ cts.	
Akins, J. R.	.....	154	.....	10	164	25,208	153 71	Day.
Allison, C. B.	222	24	197	.....	443	7,888	17 81	Contract.
Aylsworth, C. F.	.....	.....	19	159	178	10,238	57 52	Day.
Bennett, G. A.	2	.....	20	145	167	5,657	33 88	"
Berry, E. W.	159	44	61	.....	264	10,300	39 02	"
Blanchet, G. H.	.....	126	.....	.....	126	16,897	134 10	"
Bowman, E. P.	175	6	25	.....	206	6,118	29 70	Contract.
Brenot, L.	170	47	52	.....	269	19,408	72 15	Day.
Calder, J. A.	48	.....	73	6	127	7,729	60 86	"
Campbell, A. S.	.....	.....	80	138	218	6,775	31 08	"
Christie, W.	200	26	194	.....	420	8,854	21 08	Contract.
Cowper, G. C.	.....	.....	78	348	426	8,701	20 42	Day.
Cummings, A. L.	252	18	89	.....	359	8,284	23 08	Contract.
Davies, T. A.	259	35	105	.....	399	9,844	24 67	"
Day, H. S.	174	12	.....	.....	186	5,743	30 88	"
Evans, S. L.	17	8	45	275	345	8,645	25 06	Day.
Fairchild, C. C.	192	.....	6	.....	198	5,946	30 03	Contract.
Fawcett, A.	269	23	108	.....	400	8,827	22 07	"
Francis, J.	323	6	3	36	368	9,357	25 42	"
Galletly, J. S.	278	55	74	.....	407	18,942	46 54	Day.
Gibbon, Jas.	170	16	5	.....	191	5,766	30 18	Contract.
Grassie, C. A.	85	.....	71	6	162	9,610	59 32	Day.
Hawkins, A. H.	.....	163	.....	.....	163	25,272	155 04	"
Herriot, G. H.	.....	70	.....	.....	70	11,055	157 93	"
Jackson, J. E.	214	12	56	12	294	7,715	26 24	Contract.
Lighthall, A.	12	.....	61	2	75	9,207	122 76	Day.
Loucks, R. W. E.	242	48	41	.....	331	9,159	27 67	Contract.
Martindale, E. S.	58	3	11	117	189	11,140	58 94	Day.
Martyn, O. W.	176	12	7	.....	195	5,816	29 82	Contract.
Matheson, H.	42	4	2	.....	48	10,785	224 69	Day.
Melhuish, P.	26	.....	55	3	84	9,213	109 68	"
Molloy, J.	268	34	159	.....	461	10,768	23 36	Contract.
Montgomery, R. H.	230	24	58	.....	312	8,359	26 79	"
Morrier, J. E.	230	26	72	.....	328	8,853	26 99	"
MacLennan, A. L.	176	34	26	.....	236	6,589	27 92	"
McEwen, D. F.	244	48	119	.....	411	9,363	22 78	"
McFarlane, J. B.	.....	65	.....	.....	65	18,632	286 64	Day.
McFarlane, W. G.	463	74	35	.....	572	15,694	27 44	Contract.
McGrandle, H.	112	2	6	.....	120	3,873	32 27	"
McMillan, Geo.	.....	101	.....	.....	101	19,048	188 59	Day.
McNaughton, A. L.	112	22	21	.....	155	11,466	73 97	"
Neelands, R.	200	18	11	.....	229	6,624	28 92	Contract.
Neville, E. A.	.....	.....	71	8	79	7,013	88 77	Day.
Palmer, P. E.	165	21	63	.....	249	6,206	24 92	Contract.
Pierce, J. W.	256	30	12	.....	298	8,741	29 33	"
Plunkett, T. H.	4	273	.....	.....	277	33,950	122 56	Day.
Proudfoot, H. B.	111	6	20	.....	137	3,536	25 81	Contract.
Purser, R. C.	16	.....	19	70	105	5,397	51 40	Day.
Ransom, J. T.	102	16	76	.....	194	4,085	21 06	Contract.
Rinfret, C.	.....	.....	62	567	629	7,976	12 68	Day.
Robinson, E. W.	.....	96	.....	.....	96	23,165	241 30	"
Robinson, W. A.	240	32	4	.....	276	8,563	31 03	Contract.
Rolfson, O.	.....	199	.....	.....	199	19,257	96 76	Day.
Roy, J. E.	192	30	43	.....	265	6,775	25 56	Contract.
Saint Cyr, A.	.....	181	.....	.....	181	29,991	165 69	Day.
Segre, B. H.	13	.....	.....	38	51	2,486	48 74	"
Seibert, F. V.	39	.....	26	100	165	6,152	27 59	"
Soars, H. M. R.	506	112	72	.....	690	19,971	28 94	Contract.
Starkey, S. M.	230	18	196	.....	444	7,298	16 44	"
Steele, I. J.	253	52	158	.....	463	10,978	23 71	"
Stewart, A. G.	471	65	56	.....	592	17,244	29 13	"

APPENDIX No. 2—*Concluded.*

SCHEDULE showing for each surveyor employed from April 1, 1912, to March 31, 1913; the number of miles surveyed, &c.—*Concluded.*

Surveyor.	Miles of section.	Miles of outline.	Miles of traverse.	Miles of resurvey.	Total mileage.	Total cost.	Cost per mile.	Day work or contract.
						$	$ cts.	
Stewart, N. C.	89	.....	52	12	153	9,320	60 91	Day.
Stewart, W. M.	246	30	97	.....	373	7,236	19 40	Contract.
Stock, J. J.	188	6	79	.....	273	7,235	26 50	"
Street, P. B.	76	8	8	73	165	8,915	54 03	Day.
Stuart, A. G.	.....	.....	8	226	234	8,744	37 37	"
Taggart, C. H.	112	.....	15	9	136	9,638	70 87	"
Taylor, W. E.	203	19	65	.....	287	7,111	24 77	Contract.
Tipper, G. A.	509	62	32	.....	603	17,409	28 87	"
Tremblay, A. J.	299	48	85	.....	432	13,777	31 89	"
Waddell, W. H.	245	54	137	.....	436	10,277	23 57	"
Walker, C. M.	.....	.....	8	226	234	9,848	42 09	Day.
Total	10,365	2,718	3,509	2,586	19,178	781,662		

APPENDIX No. 3.

LIST of lots in the Yukon Territory, survey returns of which have been received from April 1, 1912, to March 31, 1913.

GROUP 2.

Lot No.	Acres.	Surveyor.	Year of Survey.	Date of Approval.	Claimant.	Remarks.
339	49·53	F. H. Kitto	1912	Dec. 6, 1912	Otto J. Kastner	Omenecia M. C.
347	80·9	"	1911	Dec. 6, 1912	Malcolm McLaren	Surface.
350	40·00	C. W. MacPherson	1912	Nov. 13, 1912	A. B. Devlin	Surface.

GROUP 6.

121	51·65	H. G. Dickson	1912	Nov. 13, 1912	W. J. Fleming	Empire No. 2 M. C.
122	31·28	"	1912	Jan. 10, 1913	"	Black Rock M. C.
123	20·08	"	1912	Jan. 10, 1913	"	Suburban M. C.

APPENDIX No. 4.

LIST of miscellaneous surveys in the Yukon Territory, returns of which have been received from April 1, 1912, to March 31, 1913.

Year.	Surveyor.	Description of Survey.
1908	James Gibbon	Base line of Barker Creek, a tributary of Stewart River.
1908	"	" " 51 Pup, a tributary of Barker Creek.
1908	"	" " McRae Creek, a tributary of Barker Creek.
1908	"	" " Agate Creek, a tributary of Barker Creek.
1908	"	" " Preacher Creek, a tributary of Barker Creek.
1908	"	" " Iron Creek, a tributary of Barker Creek.
1908	"	Stewart River reference traverse from Stewart crossing to Barker Creek.
1912	F. H. Kitto	Base line of Scroggie Creek, a tributary of Stewart River.
1912	"	" " Walhalla Creek, a tributary of Scroggie Creek.
1912	"	" " Alberta Creek, a tributary of Scroggie Creek.
1912	"	" " Sharpe Creek, a tributary of Scroggie Creek.
1912	"	" " Mariposa Creek, a tributary of Scroggie Creek.
1912	"	" " Stevens Creek, a tributary of Scroggie Creek.
1912	"	" " Clarke Creek, a tributary of Scroggie Creek.
1912	"	Amended survey of lower part of the Sulphur Creek base line.
1912	"	Timber berth No. 143 and part of No. 119 on Klondike River.
1912	"	Tie of Astronomical Pier at Tantalus to Carmack's reference traverse.

APPENDIX No. 5.

STATEMENT of work executed in the office of the Chief Draughtsman:—

Letters of instruction to surveyors	315
Progress sketches received and filed	1,372
Declarations of settlers received and filed	176
Returns of timber berths received	13
Plans received from surveyors	254
Field books received from surveyors	635
Timber reports received	210
Observations for magnetic declination received	931
Miscellaneous returns received	168
Preliminary township plans prepared	334
Sketches made	6,020
Maps and tracings made	434
Plans of Yukon lots received	6
Plans of miscellaneous Yukon surveys received	17
Returns of surveys examined—	
Township subdivision	233
Township outline	274
Road plans	341
Railway plans	155
Yukon lots	6
Miscellaneous Yukon surveys	17
Mineral claims	18
Timber berths	25
Correction and other miscellaneous surveys	184

APPENDIX No. 5—*Concluded.*

STATEMENT of work executed in the office of the Chief Draughtsman—*Concluded.*

Township plans compiled	700
Townsite settlement and other plans compiled	87
Proofs of plans examined	53
Township plans printed	517
Townsite and settlement plans printed	9
Miscellaneous plans printed	153
Areas calculated	940
Pages of field notes copied	368
Applications for various information dealt with	1,727
Files received and returned	1,845
Letters and memoranda drafted	10,801
Books received from Record Office and used in connection with office work	3,632
Books returned to Record Office	4,278
Plans other than printed township plans received from Record Office and used in connection with office work	723
Plans returned to Record Office	1,104
Volumes of plans received from Record Office and used in connection with office work	86
Volumes of plans returned to Record Office	83
Books sent to Record Office to be placed on record	483
Plans other than township plans sent to Record Office to be placed on record	138
Sectional maps (3 miles to 1 inch)—	
Revised	43
Reprinted	46
Sectional maps (6 miles to 1 inch)—	
Reprinted	38

APPENDIX No. 6.

LIST of new editions of Sectional Maps issued from April 1, 1912, to March 31, 1913.

Scale—3 miles to one inch.

No.	Name.	No.	Name.	No.	Name.	No.	Name.
14	Pincer Creek	111	Kamloops	215	Red Deer	316	Vermilion.
16	Milk River	112	Sicamous	217	Tramping Lake	317	Fort Pitt.
17	Cypress	114	Calgary	218	Saskatoon	364	Fort Assiniboine.
19	Willowbunch	115	Blackfoot	219	Humboldt	365	Victoria.
20	Souris	116	Rainy Hills	222	Waterhen	366	Saddle Lake.
22	Dufferin	117	Red Deer Forks	262	Yellowhead	367	Meadow Lake.
24	Lake of the Woods	118	Rush Lake	263	Jasper	368	Green Lake.
64	Porcupine	161	Morley	264	Brazeau	412	Wapiti.
66	Medicine Hat	166	Sounding Creek	265	Peace Hills	416	La Biche.
67	Maple Creek	167	Bad Hills	267	Battleford	464	Giroux.
69	Moosejaw	168	The Elbow	268	Carlton	513	Heart River.
70	Moose Mountain	169	Touchwood	314	St. Ann.		
74	Cross Lake	171	Duck Mountain	315	Edmonton.		

Scale—6 miles to one inch.

16	Milk River	74	Cross Lake	213	Athabaska	315	Edmonton.
17	Cypress	111	Kamloops	217	Tramping Lake	316	Vermilion.
19	Willowbunch	112	Sicamous	218	Saskatoon	317	Fort Pitt.
20	Souris	116	Rainy Hills	222	Waterhen	366	Saddle Lake.
22	Dufferin	117	Red Deer Forks	264	Brazeau	412	Wapiti.
24	Lake of the Woods	165	Rosebud	266	Ribstone Creek	462	Dunvegan.
64	Porcupine	167	Bad Hills	268	Carlton.		
67	Maple Creek	169	Touchwood	313	Brulé.		

APPENDIX No. 7.

STATEMENT of work executed in the Photographic office from April 1, 1912, to March 31, 1913.

—	3¼ x 3¼	3¼ x 5½	5 x 7	8 x 10	10 x 12	11 x 14	15 x 18	16 x 18	18 x 20	20 x 24	24 x 30	24 x 32	24 x 35	30 x 36	32 x 49	36 x 42	42 x 48	Total.
Dry plates and films	12	659	625	17	.....	15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,328
Bromide prints	.....	2	12	104	14	353	.....	105	25	112	77	.....	.....	92	.....	43	17	956
Solio prints	.....	31	361	344	1	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	739
Velox prints	.....	5,874	4,387	19	.....	78	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10,358
Artura prints	.....	.....	.....	62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	62
Vandyke prints	.....	.....	9	6	84	3	.....	31	73	94	246	.....	.....	235	.....	166	16	963
Blue prints	.....	.....	14	53	36	60	.....	277	158	130	168	.....	.....	307	.....	110	29	1,342
Lantern transparencies	181	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	181
Photographs mounted	.....	18	36	34	.....	8	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	97
Wet plate negatives	.....	.....	.....	99	.....	228	744	.....	170	79	.....	55	.....	.....	.....	.....	.....	1,375
Photo-litho plates	.....	.....	.....	.....	.....	.....	.....	.....	155	52	.....	.....	126	.....	194	.....	.....	527
Total	193	6,584	5,444	738	135	747	744	414	581	467	491	55	126	634	194	319	62	17,928

APPENDIX No. 8.

STATEMENT of work executed in the Lithographic Office from April 1, 1912, to March 31, 1913.

Month.	Maps.			Township Plans.			Forms.		
	No.	Copies.	Impressions.	No.	Copies.	Impressions.	No.	Copies.	Impressions.
1912.									
April	11	7,675	19,675	22	4,400	5,000	1	200	400
May	11	5,000	14,975	55	11,000	11,200	6	8,287	8,587
June	20	13,900	28,900	70	14,000	14,400	1	2,000	2,000
July	10	9,375	25,225	17	3,400	4,000	2	950	1,400
August	27	12,850	13,225	30	6,000	6,600	1	1,000	1,000
September	15	6,900	6,900	89	17,800	18,600	1	700	700
October	14	6,190	6,190	9	1,800	2,200	3	4,000	4,000
November	2	325	325	11	2,200	2,200	1	600	600
December	5	2,500	2,500	42	8,400	8,400	2	1,013	1,013
1913.									
January	11	32,215	135,045	73	14,600	14,800	5	21,000	23,000
February	6	2,725	2,725	40	8,000	8,000	6	9,500	9,500
March	9	2,000	2,500	93	18,600	19,000	3	5,300	5,400
Total	141	101,655	258,185	551	110,200	114,400	32	54,550	57,600

RECAPITULATION.

—	No.	Copies.	Impressions.	Cost.
				$
Maps	141	101,655	258,185	2,706 66
Township plans	551	110,200	114,400	4,088 00
Forms	32	54,550	57,600	617 34
Grand total	724	266,405	430,185	7,412 00

LIST of employees of the Topographical Surveys Branch at Ottawa, giving the name, classification, duties of office and salary of each. (Metcalfe street, corner of Slater.)

NAME.	CLASSIFICATION. Division.	Sub-division.	Duties of Office.	Salary.
				$
Deville, E., D.T.S., LL.D	1	A	Surveyor General	3,750
	Correspondence.			
Brady, M	1	B	Secretary	2,500
Cullen, M. J	3	A	Stenographer	1,200
Moran, J. F	3	A	Clerk	950
Williams, E. R	3	A	Correspondence clerk	950
Addison, W. G	3	B	Typewriter	800
Renault, J. F	3	B	"	700
Pegg, A			Messenger	800
O'Meara, M. T			"	600
	Accounts.			
Hunter, R. H	2	A	Accountant	2,100
Lemay, A	2	A	Asst. Accountant	1,600
Wilkinson, Percy	3	A	"	1,150

Chief Draughtsman's Office (Metcalfe street, corner of Slater)—General Direction and Supervision of the Technical Work.

Shanks, T., B.A.Sc., D.L.S	1	B	Chief draughtsman	2,650
Brown, T. E., B.A	1	B	Asst. chief draughtsman	2,650

Chief Draughtsman's Office, First Section (Metcalfe street, corner of Slater)—Survey instructions and general information.

Barber, H. G., Grad. S.P.S	2	A	Chief of section	1,950
Rice, F. W., Grad. School of Mining	2	A	Asst. chief of section	1,950
MacIlquham, W. L., B.Sc	2	A	" "	1,950
Weld, W. E	2	A	" "	1,950
Peaker, W. J., Grad. S.P.S	2	A	" "	1,650
Carroll, M. J., Grad. S.P.S	2	A	" "	1,600
Rochon, E. C	2	A	" "	1,600
McRae, A. D., B.A., B.Sc	2	B	Draughtsman	1,450
Grant, A. W., B.A	2	B	"	1,450
Hayward, H. E., B.Sc	2	B	"	1,350
MacMillan, J. P., B.E	2	B	"	1,350
Wadlin, L. N., B.Sc	2	B	"	1,250
Cordukes, J. P., B.Sc	2	B	"	1,250
Gagnon, J. N. H., B.A.S	2	B	"	1,100
Armstrong, W. B., B.Sc	2	B	"	1,250
Nevins, L. A., B.A	2	B	"	1,250
McDonald, J. F., B.A	2	B	"	1,250
Sammon, J. J., B.A	2	B	"	1,200
Fleming, A. C., B.A	2	B	"	1,200
Kydd, Geo., B.Sc	2	B	"	1,200
Quinlan, L. J., B.A.Sc	2	B	"	1,200
Mills, T. S., B.A., B.Sc	2	B	"	1,200
Holbrook, C. H	3	A	Clerk	1,000
Burkholder, E. L	3	A	"	950

Chief Draughtsman's Office, Second Section (Metcalfe street, corner of Slater)—Surveys in Manitoba, Saskatchewan, Alberta and Yukon Territory.

Name.	Classification. Division.	Classification. Sub-division.	Duties of Office.	Salary.
				$
Nash, T. S., Grad. S.P.S., D.L.S.	1	B	Chief of section	2,650
Dennis, E. M., B. Sc.	2	A	Asst. chief of section	1,950
Elder, A. J., Grad. S.P.S., D.L.S.	2	A	" "	1,950
Hill, S. N., Grad S.P.S.	2	A	" "	1,950
Genest, P. F. X., Q.L.S.	2	A	" "	1,950
Kitto, F. H., D.L.S.	2	A	In charge of Dawson office	1,650
Sutherland, H. E., B.Sc.	2	A	Asst. chief of section	1,600
McClennan, W. D.	2	A	" "	1,600
Roger, A., O.L.S.	2	A	" "	1,600
Spreckley, R. O.	2	B	Draughtsman	1,550
Goodday, Leonard	2	B	"	1,450
Bray, R. P.	2	B	"	1,450
Harrison, E. W.	2	B	"	1,350
Ault, H. W.	2	B	"	1,350
Lytle, W. J.	2	B	"	1,100
LaBeree, E. E.	2	B	"	1,100
Jones, G. S., Grad. S.P.S., O.L.S.	2	B	"	1,100
Bradley, J. D.	2	B	"	1,100
Fournier, O. E., B.A.S.	2	B	"	1,100
Thomas, A. S., B.Sc.	2	B	"	1,250
Kirwan, A. L., B.A.Sc.	2	B	"	1,200
Robinson, S. D., B.Sc.	2	B	"	1,200
Macdonald, J. A.	3	B	Clerk	800

Chief Draughtsman's Office, Third Section—(Imperial Building, Queen street). Copying plans for reproduction.

Engler, Carl., B. A., D.L.S.	1	B	Chief of section	2,200
May, J. E.	2	A	Asst. chief of section	1,950
O'Connell, J. R.	2	A	" "	1,750
Moule, W. J	2	B	Draughtsman	1,600
Helmer, J. D.	2	B	"	1,150
Dawson, R. J	2	B	"	1,150
Archambault, E.	2	B	"	1,150
Clarke, G, N	2	B	"	800
Watters, James	3	A	Printer	1,200
McLennan, A. G.	3	A	Clerk	1,200
Brown, A.	3	A	"	950
Ebbs, E. J.	3	A	"	950
Baril, C.	3	B	Draughtsman	800

Chief Draughtsman's Office, Fourth Section—(Imperial Building, Queen street). British Columbia surveys.

Rowan-Legg, E. L.	2	A	Chief of section	2,100
Gillmore, E. T B., Grad, R.M.C.	2	A	Asst. chief of section	2,050
Morley' R. W.	2	A	" "	1,950
Wilson, E. E. D., B. Sc.	2	A	" "	1,650
Harris, K. D.	2	B	Draughtsman	1,350

Chief Draughtsman's Office, Fifth Section—(Imperial Building, Queen street). Mapping.

Name.	Classification. Division.	Sub-division.	Duties of Office.	Salary
				$
Smith, J.	1	B	Chief of section	2,650
Begin, P. A.	2	A	Asst. chief of section	2,000
Blanchet, A. E.	2	A	" "	1,600
Côté, J. A., Grad. R.M.C.	2	A	" "	1,650
D'Orsonnens, A	2	A	" "	1,600
Flindt, A. H.	2	A	" "	1,750
Bergin, W.	2	B	Draughtsman	1,150
Blanchard, J. F.	2	B	"	1,100
Brigly, J. H.	2	B	"	1,350
Colquhoun, G. A., B. Sc.	2	B	"	1,250
Davies, T. E. S.	2	B	"	1 600
Davy, E.	2	B	"	1,450
Freeland, J. J., M.A.	2	B	"	1,250
Howie, Jas.	2	B	"	1,050
Perrin, V.	2	B	"	1,600
Purdy, W.A.	2	B	"	1,150
Villeneuve, E.	2	B	"	1,150

Chief Draughtsman's Office, Sixth Section—(Imperial Building, Queen street). Scientific and topographical work.

Dodge, G. B., D.L.S	1	B	Chief of section	2,650
Watt, G. H., Grad. S.P.S., D.L.S.	2	A	Asst. chief of section	1,950
Cannell, H. W.	2	B	Draughtsman	1,200
Chartrand, D. E., B.Sc.	2	B	"	1,150
Cousineau, A., B.Sc.	2	B	"	1,150
Dozois, L. O. R., Grad. R.M.C.	2	B	"	1,150
Herbert, W. H., B.Sc.	2	B	"	1,250
Hill, Jas., M.A., B.Sc.	2	B	"	1,200
Hughson, W. G., B.Sc.	2	B	"	1,200
Milliken, J, B., B.A., B.Sc., D.L.S	2	B	"	1,350
Parry, H., B.Sc., D.L.S.	2	B	"	1,050
Roe, B. J.	2	B	"	1,200
Ross, R. C., B.Sc.	2	B	"	1,250
Way. W. C., M.Sc.	2	B	"	1,200
Lynch, F. J.	3	B	Typewriter	800
Watson, J. W.	3	B	Clerk	800
Pick, A. C.	.....	.....	Messenger	550

Geographic Board (Woods Building, Slater street).

Whitcher, A. H., F.R.G.S., D.L.S.	2	A	Secretary	2,100

Photographic Office (Metcalfe street, corner Slater street).

Carruthers, H. K.	2	A	Process photographer	1,950
Woodruff, John	2	A	Chief "	1,950
Smith, L. G.	2	B	Photographer	850
Whitcomb, H. E	3	A	"	1,200
Morgan, W. E.	3	A	"	1,200
Kilmartin, A.	3	A	Asst. photographer	950
Devlin, A.	3	B	"	800
Ouimet. E. G.	3	B	"	800

Lithographic Office (unclassified) (Imperial Building, Queen street).

Name.	Occupation.	Salaries.
Moody, A	Foreman	$27 00 per week.
Burnett, E.	Lithographer	25 00 "
Thicke, C. R	"	23 00 "
Deslauriers, J. H	Transferrer	20 00 "
Bergin, J	Printer	21 00 "
Thicke, H. S	"	20 00 "
Boyle, S	Stone polisher	15 00 "
Gagnon, J	Press feeder	12 00 "
Kane, P	"	9 50 "
Easton, R. M	Printer	19 50 "
Hare, E. H	Asst. photographer	15 00 "

Chief Inspector of Surveys Office (98 Wellington street).

Name.	Classification.		Duties of Office.	Salaries.
	Division.	Sub-division.		
				$
Hubbell, E. W., D.L.S	1	B	Chief inspector	2,800
Sylvain, John	2	A	Assistant	1,700
Stalker, Miss M. W	3	A	Clerk	950

Board of Examiners for D.L.S.

F. D. Henderson, Grad. S.P.S	2	A	Secretary	1,950

APPENDIX No. 10.

LIST of Dominion Land Surveyors who are in possession of Standard Measures.

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Akins, James Robert	Ottawa, Ont	Sept. 2, '76	Mar. 14, '10	
Allison, Calvin Bruce	South Woodslee, Ont.	June 16, '84	Mar. 28, '10	O.L.S.
Ashton, Arthur Ward	Ottawa, Ont	Nov. 5, '80	May 29, '08	B.C.L.S.
Austin, George Frederick	Not known	.....	April 14, '72	
Aylen, John	North Bay, Ont	.....	May 29, '85	
Aylsworth, Charles Fraser	Madoc, Ont	April 21, '62	May 13, '86	O.L.S.
Baker, James Clarence	Vermilion, Alta	May 12, '78	May 18, '06	A.L.S.
Baker, Mason Hermon	St. Thomas, Ont	July 9, '84	Aug. 6, '08	O.L.S.
Bartlett, Ernest	Medicine Hat, Alta.	——— '83	Jan. 16, '11	A.L.S.
Bayne, George A	Winnipeg, Man	Oct. 25, '50	April 14, '72	M.L.S.
Beatty, David	Parry Sound, Ont	Dec. 22, '42	April 14, '72	O.L.S.
Begg, William Arthur	Hamilton, Ont	July 15, '82	June 8, '09	S L.S.
Belanger, Phidime Roch Arthur	Ottawa, Ont	Mar. 5, '53	May 17, '80	Inspector of Surveys, Topographical Surveys Branch, Dept. of the Interior-
Belleau, Joseph Alphonse	Ottawa, Ont	Sept. 30, '56	May 15, '83	Land Patents Branch, Department of Interior.
Belyea, Albert Palmer Corey	Edmonton, Alta	.....	July 14, '09	A.L.S.
Bemister, George Bartlett	Winnipeg, Man	.....	June 11, '78	M.L.S. Engineering Dept. C.N.R.
Bennett, George Arthur	Calgary, Alta	May 18, '86	Aug. 25, '10	A.L.S.
Berry, Edward Wilson	Seaforth, Ont	Aug. 26, '81	May 18, '11	
Bigger, Charles Albert	Ottawa, Ont	Aug. 15, '53	Mar. 30, '82	B.C.L.S., O.L.S., Assistant Superintendent Geodetic Survey.
Bingham, Edwin Ralph	Fort William, Ont	——— '78	Oct. 25, '06	O.L.S.
Blanchet, Guy Houghton	Ottawa, Ont	Feb. 12, '84	Mar. 10, '10	
Boswell, Elias John	Montreal, Que	.....	Mar. 18, '03	O.L.S., M.L.S.
Bourgeault, Armand	St. Jean Port Joli, Que	Feb. 23, '58	Mar. 29, '83	Q.L.S.
Bourgault, Charles Eugene	Lauzon, Levis, Que.	Sept. 6, '61	Feb. 21, '88	
Bourget, Charles Arthur	Lauzon, Que	Aug. 26, '51	May 14, '84	Q.L.S.
Bowman, Edgar Peterson	West Montrose, Ont.	Sept. 29, '83	Sept. 26, '07	O.L.S.
Bowman, Herbert Joseph	Berlin, Ont	June 18, '65	Feb. 16, '88	O.L.S.
Brabazon, Alfred James	Ottawa, Ont	.....	May 13, '82	Boundary Survey, Dept. of the Interior.
Brady, James	Golden, B.C	Nov. 24, '40	April 14, '72	O.L.S., B.C.L.S.
Bray, Samuel	Ottawa, Ont	Nov. 5, '46	Nov. 14, '83	O.L.S., Chief Surveyor, Dept. of Indian Affairs.
Bray, Lennox Thomas	Edmonton, Alta	Mar. 14, '77	Feb. 18, '03	O.L.S., A.L.S.
Brenot, Lucien	Ottawa, Ont	Aug. 31, '87	Mar. 18, '10	
Bridgland, Morrison Parsons	Calgary, Alta	Dec. 20, '78	Mar. 10, '05	A.L.S.
Broughton, George Henry	Penticton, B.C	Aug. 12, '86	June 3, '09	B.C.L.S.
Brown, Charles Dudley	Winnipeg, Man	Feb. 25, '83	April 4, '10	A.L.S., S.L.S.
Brown, Edgar Carl	Regina, Sask	Nov. 28, '86	May 23, '11	A.L.S., S.L.S.
Brown, Thomas Wood	Regina, Sask	.....	June 21, '09	A.L.S., S.L.S.
Brownlee, James Harrison	Vancouver, B.C	Mar. 22, '56	April 15, '87	M.L.S., B.C.L.S.
Buchanan, John Alexander	Edmonton, Alta	Mar. 4, '87	May 17, '12	A.L.S.
Burd, James Henry	Weyburn, Sask	Sept. 7, '71	May 18, '11	O.L.S., S.L.S.
Burgess, Edward LeRoy	Victoria, B.C	May 5, '78	Feb. 23, '05	O.L.S.
Burnet, Hugh	Victoria, B.C.	.....	June 22, '85	O.L.S., B.C.L.S.
Burwash, Nathaniel Alfred	Whitehorse, Y.T	Sept. 28, '79	Mar. 6, '07	O.L.S.
Burwell, Herbert Mahlon	Vancouver, B.C	Oct. 23, '63	Feb. 17, '87	B.C.L.S.
Calder, John Alexander	Lytton, B.C	June 2, '86	May 21, '12	
Campbell, Alan John	Sidney, B.C	Oct. 1, '82	April 13, '09	B.C.L.S., A.L.S.
Campbell, Alexander Stewart	Kingston, Ont	Mar. 7, '80	Mar. 6, '09	O.L.S.
Carbert, Joseph Alfred	Medicine Hat, Alta.	Feb. 4, '56	May 12, '80	O.L.S., A.L.S., District Engineer and Surveyor, Dept. of Public Works, Alberta.
Carpenter Henry Stanley	Regina, Sask	Feb. 8, '74	Feb. 20, '01	O.L.S., S.L.S., Department of Public Works.
Carroll, Cyrus	Regina, Sask	Dec. 6, '34	April 14, '72	O.L.S., S.L.S.

APPENDIX No. 10—*Continued.*

LIST of Dominion Land Surveyors who are in possession of Standard Measures.—*Continued.*

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Carson, Percy Alexander	Kamloops, B.C.	Dec. 25, '77	Feb. 22, '06	Hydrographic Survey.
Carthew, William Morden	Edmonton, Alta.	Oct. 19, '86	Mar. 29, '10	A.L.S.
Carthew, John Trewalla	Edmonton, Alta.	Feb. 15, '91	Mar. 15, '13	
Cautley, Reginald Hutton	Edmonton, Alta.	Dec. 6, '79	May 1, '05	A.L.S.
Cautley, Richard William	Edmonton, Alta.	Aug. 3, '73	Sept. 2, '96	A.L.S.
Cavana, Allan George	Orillia, Ont.	Jan. 22, '58	Nov. 16, '76	O.L.S.
Charlesworth, Lionel Clare	Edmonton, Alta.	Nov. 17, '73	Mar. 24, '03	O.L.S., A.L.S., Dept. of Pub. Works, Alberta.
Chase, Albert Victor	Orillia, Ont.	Mar. 4, '83	Oct. 11, '10	O.L.S.
Chilver, Charles Alonzo	Walkerville, Ont.	Feb. 8, '83	Feb. 22, '07	
Christie, William	Prince Albert, Sask.	Feb. 13, '76	Mar. 22, '06	S.L.S.
Clarke, Charles Wentworth	Regina, Sask.	Nov. 19, '75	Mar. 24, '10	S.L.S.
Cleveland, Ernest Albert	Vancouver, B.C.	May 12, '74	June 27, '99	B.C.L.S.
Coates, Preston Charles	Victoria, B.C.	May 16, '81	April 19, '07	B.C.L.S.
Cokely, Leroy S	Duncan, B.C.	Nov. 23, '84	Mar. 22, '10	B.C.L.S.
Cond, Fritz Thomas Piercy	Vancouver, B.C.	May 16, '86	May 18, '11	B.C.L.S.
Côté, Joseph Adélard	Prince Albert, Sask.	June 5, '64	May 14, '84	S.L.S.
Côté, Jean Léon	Edmonton, Alta.	May 6, '67	Mar. 21, '90	A.L.S.
Cotton, Arthur Frederick	Massett, B.C	Aug. 8, '52	May 11, '80	O.L.S., B.C.L.S.
Cowper, George Constable	Welland, Ont.	Oct. 20, '86	Mar. 11, '11	
Craig, John Davidson	Ottawa, Ont.	Jan. 30, '76	Feb. 24, '02	Boundary Surveys, Dept. of the Interior.
Cumming, Austin Lewis	Edmonton, Alta.	Aug. 25, '82	Feb. 3, '10	A.L.S.
Cummings, Alfred	Fernie, B.C.	July 3, '80	Mar. 3, '09	B.C.L.S.
Cummings, John George	Cranbrook, B.C.	Nov. 19, '73	Feb. 17, '04	B.C.L.S.
Dalton, John Joseph	Weston, Ont	June 12, '54	Apr. 17, '79	O.L.S., D.T.S.
Davies, Thomas Attwood	Edmonton, Alta.	.....	Feb. 22, '06	A.L.S.
Dawson, Frederick James	Kamloops, B.C.	Sept. 22, '86	Sept. 12, '10	B.C.L.S.
Day, Harry Samuel	Edmonton, Alta	Nov. 14, '85	Mar. 9, '10	A.L.S.
Deans, William James	Brandon, Man.	May 4, '60	May 13, '86	O.L.S.
de la Condamine, C	Calgary, Alta.	Feb. 13, '75	May 4, '10	A.L.S.
Dennis, John Stoughton	Calgary, Alta.	Oct. 22, '56	Nov. 19, '77	D.T.S.
Denny, Herbert C	Not known.	.....	Apr. 1, '82	
Dickson, Henry Godkin	Whitehorse, Y.T.	Mar. 29, '64	Mar. 19, '89	M.L.S.
Dickson, James	Fenelon Falls, Ont.	Oct. 30, '34	Apr. 14, '72	O.L.S.
Dobie, James Samuel	Thessalon, Ont.	Oct. 15, '73	Mar. 22, '06	O.L.S.
Donnelly, Cecil	Winnipeg, Man.	Oct. 18, '89	Mar. 15, '13	
Doupe, Jacob Lonsdale	Winnipeg, Man.	Sept. 14, '67	Oct. 6, '88	M.L.S., A.L.S., S.L.S., Asst. Land Commissioner for C.P.R.
Drewry, William Stewart	Victoria, B.C.	Jan. 20, '59	Nov. 14, '83	O.L.S., B.C.L.S.
Driscoll, Alfred	Edmonton, Alta.	July 2, '65	Feb. 23, '87	B.C.L.S., A.L.S.
Drummond, Thomas	Montreal, P.Q.	 1856	June 24, '78	D.T.S.
Ducker, William A.	Winnipeg, Man.	April 4, '52	Mar. 30, '83	O.L.S., M.L.S.
Dumais, Paul T. Concorde	Hull, P.Q.	Jan. 2, '47	Mar. 29, '82	Q.L.S.
Earle, WallaceSinclair	Victoria, B.C.	Feb. 8, '89	May 18, '11	B.C.L.S., O.L.S.
Edwards, George	Ponoka, Alta.	June 13, '42	Apr. 14, '72	O.L.S., A.L.S.
Edwards, William Milton	Lethbridge, Alta.	June 21, '79	Apr. 5, '10	A.L.S.
Ellacott, Charles Herbert	Victoria, B.C.	Dec. 24, '66	Feb. 22, '99	B.C.L.S.
Ellis, Douglas Stewart	Kingston, Ont.	Mar. 16, '85	May 17, '12	
Empey, John Morgan	Calgary, Alta.	Apr. 16, '74	Feb. 23, '05	O.L.S., A.L.S.
Engler, Carl	Ottawa, Ont.	Sept. 30, '72	Feb. 23, '05	T. S. Branch, Dept. of Interior.
Evans, Stanley Livingstone	Corinth, Ont.	Jan. 14, '84	Feb. 13, '11	
Fairchild, Charles Courtland	Edmonton, Alta.	Feb. 21, '67	Feb. 20, '01	O.L.S., A.L.S.
Farncomb, Alfred Ernest	Edmonton, Alta.	May 22, '73	Mar. 12, '02	O.L.S., A.L.S.
Fawcett, Thomas	Ottawa, Ont.	Oct. 28, '48	Nov. 18, '76	O.L.S., D.T.S., Boundary Surveys, Dept. of Interior.
Fawcett, Adam	Gravenhurst, Ont.	.....	Feb. 22, '93	
Ferguson, George Hendry	Toronto, Ont.	Jan. 20, '83	June 2, '09	
Findlay, Allan	Winnipeg, Man.	Oct. 15, '80	Mar, 21, '08	M.L.S.
Fletcher, James Allan	Fletcher, Ont.	Mar. 26, '89	May 18, '11	

APPENDIX No. 10—*Continued.*

LIST of Dominion Land Surveyors who are in possession of Standard Measures—*Continued.*

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Fontaine, Louis Elie	Levis, P.Q	Oct. 3, '68	Nov. 30, '92	A.L.S., Inspector of Surveys, Dept. of Interior.
Francis, John	Portage la Prairie, M	Dec. 22, '52	June 17, '75	M.L.S.
Galletly, James Simpson	Brooklin, Ont	Apr. 15, '88	May 18, '11	
Garden, James Ford	Vancouver, B.C	Feb. 19, '47	May 13, '80	B.C.L.S.
Garden, George H	Lethbridge, Alta		Apr. 14, '72	Deputy Surveyor for N.B
Garden, Charles	Not known		Apr. 14, '72	Deputy Surveyor for N.B.
Garner, Albert Coleman	Regina, Sask	Sept. 6, '78	May 27, '07	S.L.S., A.L.S., Chief Surveyor Surveys Branch Land Titles Offices.
Gauvreau, Louis Pierre	Not known		Apr. 14, '72	
Gibbon, James	Vancouver, B.C	June 25, '60	Feb. 12, '91	O.L.S.
Glover, Arthur Edward	Edmonton, Alta	Mar. 4, 87	Mar. 11, '11	A.L.S., S.L.S.
Gordon, Maitland Lockhart	Vancouver, B.C	Sept. 27, '82	Feb. 18, '04	B.C.L.S.
Gordon, Robert John	Lethbridge, Alta	June 18, '69	Mar. 12, '02	A.L.S.
Gore, Thomas Sinclair	Victoria, B.C	1852	Apr. 19, '79	B.C.L.S.
Graham, John Robertson	Vancouver, B.C	Apr. 18, '87	May 26, '10	B.C.L.S.
Grassie, Charles Andrew	Medicine Hat, Alta	Dec. 24, '83	Dec. 27, '10	A.L.S.
Gray, James Edward	Edmonton, Alta	Oct. 12, '81	Mar. 11, '11	A.L.S., S.L.S.
Green, Alfred Harold	Nelson, B.C	Jan. 20, '79	Feb. 23, '05	B.C.L.S., A.L.S.
Green, Thomas Daniel	Ottawa, Ont	Dec. 21, '57	May 19, '84	O.L.S.
Green, Frank Compton	Victoria, B.C		May 8, '03	B.C.L.S.
Grover, George Alexander	Toronto, Ont		Feb. 18, '04	
Haggen, Rupert Williams	Quesnel, B.C	July 29, '87	May 18, '11	B.C.L.S.
Hamilton, Charles Thomas	Vancouver, B.C	July 29, '84	May 18, '11	B.C.L.S.
Hamilton, James Frederick	Lethbridge, Alta	April 4, '69	June 2, '09	A.L.S.
Harris, John Walter	Winnipeg, Man	Feb. 26, '45	April 14, '72	O.L.S., M.L.S., Assessment Commissioner and City Surveyor.
Harrison, Edward	Calgary, Alta		May 14, '10	A.L.S.
Harvey, Charles	Kelowna, B.C	May 5, '76	Feb. 17, '04	B.C.L.S.
Hawkins, Albert Howard	Listowel, Ont	July 27, '62	Mar. 6, '06	
Heaman, John Andrew	Winnipeg, Man	June 3, '75	July 15, '09	O.L.S.
Heathcott, Robert Vernon	Edmonton, Alta	July 7, '81	May 13, '07	A.L.S.
Henderson, Walter	Not known		Nov. 17, '83	
Herriot, George Henry	Souris, Man	Feb. 23, '83	Sept. 18, '09	
Heuperman, Frederick Justinus	Calgary, Alta	July 23, '87	Mar. 13, '11	A.L.S.
Heuperman, Lambertus Fred	Calgary, Alta	Sept. 20, '81	Mar. 29, '10	A.L.S.
Hoar, Charles Millard	Calgary, Alta	Sept. 26, '85	Mar. 9, '11	A.L.S.
Hobbs, Wilfrid Ernest	Winnipeg, Man	Mar, 12, '87	Mar. 5, '12	M.L.S.
Holcroft, Herbert Spencer	Toronto, Ont	Sept. 4, '77	Feb. 18, '03	O.L.S.
Hopkins, Marshall Willard	Edmonton, Alta	May 24, '61	Feb. 20, '01	O.L.S., A.L.S.
Hubbell, Ernest Wilson	Ottawa, Ont	Nov. 5, '62	May 19, '84	Chief Inspector of Surveys, Dept. of Interior.
Inkster, Oluff	Edmonton, Alta	Mar. 25, '85	May 18, '11	A.L.S.
Jackson, John Edwin	Hamilton, Ont	Dec. 27, '81	May 18, '11	O.L.S.
James, Silas	Toronto, Ont	June 19, '34	April 14, '72	O.L.S.
Jephson, Richard Jermy	Brandon, Man	Feb. 5, '54	May 12, '80	O.L.S., B.C.L.S., M.L.S
Johnson, Alfred William	Kamloops, B.C	Feb. 23, '74	Mar. 12, '02	B.C.L.S.
Johnston, James Homer	Edmonton, Alta	Aug. 23, '87	May 17, '12	A.L.S.
Keith, Homer Pasha	Edmonton, Alta	Aug. 30, '85	Feb. 1, '11	A.L.S.
Kimpe, Maurice	Edmonton, Alta	Jan. 17, '76	May 13, '07	A.L.S.
King, William Frederick	Dominion Observatory, Ottawa, Ont.	Feb. 19, '54	Nov. 21, '76	D.T.S. Chief Astronomer Dept. of Interior.
Kirk, John Albert	Summerland, B.C	Jan. 9, '54	May 11, '80	O.L.S., B.C.L.S.
Kitto, Franklin Hugo	Dawson, Y.T	Mar. 28, '80	Mar. 6, '08	
Klotz, Otto Julius	Dominion Observatory, Ottawa, Ont.	Mar. 31, '52	Nov. 19, '77	O.L.S., D.T.S., Astronomer, Dept. of Interior.
Knight, Richard H	Edmonton, Alta	June 7, '77	Feb. 18, '04	A.L.S.
Lamb, Frederick Carlyle	Saskatoon, Sask	Dec. 11, '88	May 17, '12	
Lang, John Leiper	Sault Ste. Marie, Ont		Oct. 14, '08	O.L.S.
Latimer, Frank Herbert	Penticton, B.C	May 23, '60	Nov. 13, '85	B.C.L.S.

APPENDIX No. 10—*Continued.*

LIST of Dominion Land Surveyors who are in possession of Standard Measures—*Continued.*

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Laurie, Richard C	Battleford, Sask	Jan. 31, '58	April 27, '83	S.L.S.
Lemoine, Charles Errol	Ville Montcalm, P.Q.	.....	Mar. 31, '82	Q.L.S.
Lighthall, Abram	Vancouver, B.C.	Mar. 30, '78	Dec. 25, '09	
Lindsay, James Herbert	Prince Albert, Sask.	Nov. 27, '82	May 18, '11	S.L.S.
Lonergan, Gerald Joseph	Buckingham, P.Q.	Oct, 8, '71	Feb. 28, '01	Q.L.S., A.L.S., Inspector of Surveys, Dept. of Interior.
Loucks, Roy Wm. Egbert	Saskatoon, Sask.	Oct. 31, '84	Mar. 1, '12	A.L.S., S.L.S.
Lumsden, Hugh David	Ottawa, Ont	Sept. 7, '44	April 14, '72	O.L.S.
MacLennan, Alexander L	Toronto, Ont	May 10, '78	Feb. 23, '05	S.L.S.
MacLeod, George Waters	Edmonton, Alta	—— '88	Mar. 1, '12	A.L.S.
MacPherson, Charles Wilfrid	Dawson, Y.T	Sept. 6, '71	Mar. 7, '00	O.L.S.
Macdonald, Gordon Alexander	Muirkirk, Ont	May 24, '85	May 17, '12	
Magrath, Charles Alexander	Ottawa, Ont	April 22, '60	Nov. 16, '81	B.A.Sc., O.L.S., B.C.L.S D.T.S., Member International Waterways Commission.
Martindale, Ernest Smith	Kingsmill, Ont.	May 20, '86	Mar. 11, '11	
Martyn, Oscar William	Regina, Sask.	Dec. 2, '88	Mar. 11, '11	S.L.S.
Matheson, Hugh	Ottawa, Ont	May 2, '79	May 9, '11	
Meadows, William Walter	Maple Creek, Sask.	May 27, '73	Feb. 23, '05	O.L.S., S.L.S.
Melhuish, Paul	Vancouver, B.C	April 14, '87	May 18, '11	B.C.L.S.
Miles, Charles Falconer	Toronto, Ont.	Jan. 30, '38	April 14, '72	O.L.S. Inspector of Surveys, Dept. of Interior.
Mitchell, Benjamin Foster	Edmonton, Alta	June 16, '80	April 16, '08	A.L.S.
Moberly, Harford Kenneth	Moosomin, Sask	———, '69	April 21, '03	S.L.S.
Molloy, John	Winnipeg, Man.	Jan. 13, '40	April 14, '72	M.L.S.
Montgomery, Royal Harp	Prince Albert, Sask.	May 20, '82	Feb. 23, '05	O.L.S., S.L.S.
Moore, Herbert Harrison	Calgary, Alta.	Dec. 1, '69	Feb. 17, '04	A.L.S.
Morrier, Joseph Eldedge	Prince Albert, Sask.	Aug. 29, '74	May 16, '07	S.L.S.
Murray, Ernest William	Regina, Sask.	Mar. 20, '84	May 31, '10	S.L.S.
McArthur, James Joseph	Ottawa, Ont	May 9, '56	April 17, '79	Boundary Surveys, Dept. of Interior.
McCaw, Robert Daniel	Sidney, B.C	May 24, '83	Mar. 23, '09	O.L.S., B.C.L.S., A.L.S.
McColl, Gilbert Beebe	Winnipeg, Man.	Oct. 8, '82	Mar. 20, '07	M.L.S.. D.T.S.
McColl, Samuel Ebenezer	Winnipeg, Man	July 17, '86	May 18, '11	M.L.S.
McDiarmid, Stuart Stanley	Vancouver, B.C	Aug. 4, '81	Feb. 23, '05	B.C.L.S.
McElhanney, Thomas Andrew.	Vancouver, B.C	April 21, '86	Mar. 17, '12	
McEwen, Duncan Findlay	Edmonton, Alta	Aug. 7, '73	May 18, '11	A.L.S.
McFadden, Moses	Vancouver, B.C	Aug. 26, '26	April 14, '72	O.L.S., M.L.S.
McFarlane, Walter Graham	Peace River Landing Alta	Sept. 28, '75	May 19, '05	A.L.S.
McFarlane, John Baird	Toronto, Ont.	Feb. 25, '79	June 3, '08	A.L.S.
McFee, Angus	Red Deer, Alta	July 14, '46	April 19, '79	A.L.S.
McGeorge, William Graham	Chatham, Ont.	Mar. 22, '87	Mar. 21, '10	O.L.S.
McGrandle, Hugh	Wetaskiwin, Alta	Mar. 12, '57	Mar. 30, '83	O.L.S., A.L.S.
McKay, Robert B	Vancouver, B.C	April 21, '83	May 21, '12	
McLean, James Keachie	Ottawa, Ont	Dec. 19, '51	April 1, '82	O.L.S., Dept. of Indian Affairs
McMaster, William Angus Alexander	Prince Albert, Sask.	Feb. 1, '85	July 6, '10	A.L.S., S.L.S.
McMillan, George	Finch, Ont.	Dec. 9, '69	Feb. 22, '06	
McNaughton, Alexander L	Cornwall, Ont	Sept. 30, '81	Feb. 23, '05	O.L.S., B.C.L.S.
McPherson, Archibald John	Regina, Sask.	———, '70	Feb. 21, '01	S.L.S.
McPhillips, George	Winnipeg, Man	April 26, '48	June 17, '75	O L.S., M.L.S., A.L.S.
McPhillips, Robert Charles	Winnipeg, Man	April 24, '56	May 17, '80	M.L.S.
McVittie, Archibald W.	Victoria, B.C	May 5, '58	Mar. 30, '82	B.C.L.S.
Narraway, Athos Maxwell	Ottawa, Ont	July 19, '88	May 18, '11	
Neelands, Rupert A	Hamiota, Man	Aug. 26, '84	Mar. 5, '12	
Nelles, Douglas Henry	Ottawa, Ont.	.....	Mar. 9, '07	
Neville, Everett A	Ruthven, Ont	Jan. 8, '87	May 18, '11	
O'Hara, Walter Francis	Ottawa, Ont.	.....	Feb. 19, '95	O.L.S.
Ord, Lewis Redman	Hamilton, Ont	Oct. 17, '56	April 1, '82	O.L.S.
Palmer, Philip Ebenezer	Dorchester, N.B.	May 6, '88	Mar. 7, '12	

APPENDIX No. 10—*Continued.*

LIST of Dominion Land Surveyors who are in possession of Standard Measures—*Continued.*

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Parsons, Johnstone Lindsay R.	Regina, Sask.	Jan. 18, '76	Feb. 23, '05	O.L.S., S.L.S.
Patrick, Allan Poyntz	Calgary, Alta.	July 18, '49	Nov. 19, '77	B.C.L.S., D.T.S., A.L.S.
Patten, Thaddeus James	Little Current, Ont.	Feb. 4, '59	Mar. 29, '83	O.L.S.
Pearce, William	Calgary, Alta.	Feb. 1, '48	May 10, '80	O.L.S., B.C.L.S., A.L.S.
Pearce, Seabury Kains	Calgary, Alta.	Dec. 6, '87	Mar. 9, '11	A.L.S.
Pearson, Hugh Edward	Edmonton, Alta.	Oct. 17, '87	May 17, '12	A.L.S.
Pequegnat, Marcel	Berlin, Ont.	April 27, '86	June 6, '10	O.L.S.
Peters, Frederic Hatheway	Calgary, Alta.	Nov. 4, '83	Mar. 4, '10	A.L.S., Com of Irrigation.
Phillips, Edward Horace	Saskatoon, Sask.	Dec. 19, '78	Feb. 24, '02	S.L.S.
Phillips, Harold Geoffrey,	Regina, Sask.	Sept. 3, '87	April 23, '10	S.L.S.
Pierce, John Wesley	Ottawa, Ont.	.....	Dec. 24, '09	O.L.S.
Pinder, George Zouch	Edmonton, Alta.	Mar. 5, '81	Mar. 15, '13	
Plunkett, Thomas Hartley	Meaford, Ont.	June 1, '78	Mar. 12, '08	
Ponton, Archibald William	Edmonton, Alta.	Jan. 25, '59	May 18, '81	O.L.S., A.L.S.
Powell, William Henry	Vancouver, B.C.	Dec. 22, '84	Feb. 22, '11	B.C.L.S.
Proudfoot Hume Blake	Saskatoon, Sask.	June 23, '58	Mar. 28, '82	O.L.S., S.L.S.
Purser, Ralph Clinton	Windsor, Ont.	April 7, '86	Feb. 2, '11	
Rainboth, Edward Joseph	Ottawa, Ont.	.....	May 19, '81	Q.L.S., O.L.S.
Ransom, John Thomas	Toronto, Ont.	Aug. 24, '88	Jan. 14, '11	O.L.S.
Reilly, William Robinson	Regina, Sask.	Aug. 10, '57	Nov. 17, '81	O.L.S., M.L.S., S.L.S.
Richard, Joseph Francois	Ste. Anne de la Pocatière, P.Q.	.....	May 13, '82	Q.L.S.
Rinfret, Claude	Montreal, P.Q.	Jan. 5, '86	Mar 20, '08	Q.L.S.
Rinfret, Raoul	Montreal, P.Q.	July 16, '56	Feb. 20, '00	Q.L.S.
Ritchie, Joseph Frederick	Prince Rupert, B.C.	May 23, '63	Jan. 7, '89	B.C.L.S.
Roberts, Sydney Archibald	Victoria, B.C.	April 10, '48	May 16, '85	B.C.L.S.
Roberts, Vaughan Maurice	Goderich, Ont.	Mar. 22, '64	May 17, '86	
Robertson, Donald Fraser	Ottawa, Ont.	'80	May 25, '09	Dept. of Indian Affairs.
Robertson, Henry H.	N.Timiskaming, P.Q.	Sept. 13, '47	April 14, '72	Q.L.S.
Robinson, Ernest Walter P.	Ottawa, Ont.	May 8, '80	May 1, '08	
Robinson, Franklin Joseph	Regina, Sask.	Oct. 20, '70	Feb. 20, '00	S.L.S., Deputy Minister of Public Works.
Robinson, William Andrew	Winnipeg, Man.	Feb. 21, '81	Oct. 2, '11	S.L.S.
Rolfson, Orville	Walkerville, Ont.	Feb. 26, '85	July 11, '08	
Rombough, Marshall Bedwell	Morden, Man.	Oct. 14, '35	April 14, '72	M.L.S.
Rorke, Louis Valentine	Toronto, Ont.	Feb. — '65	Aug. 13, '91	O.L.S., Inspector of Surveys for Ontario.
Ross, George	Welland, Ont.	June 12, '53	Nov. 21, '82	O.L.S.
Ross, Joseph Edmund	Kamloops, B.C.	Jan. 9, '61	Feb. 12, '91	O.L.S., B.C.L.S.
Routly, Herbert Thomas	Haileybury, Ont.	Jan. 20, '78	Feb. 15, '11	O.L.S.
Roy, George Peter	Quebec, P.Q.	Oct. 1, '52	Nov. 17, '81	Q.L.S.
Roy, Joseph George Emile,	Quebec, P.Q.	Mar. 14, '86	May 25, '10	Q.L.S.
Russell, Alexander Lord	Port Arthur, Ont.	.....	April 14, '72	O.L.S.
Saint Cyr, Jean Baptiste	Montreal, P.Q.	Dec. 17, '66	Feb. 17, '87	Q.L.S.
Saint Cyr, Arthur	Ottawa, Ont.	Nov. — '60	Feb. 17, '87	
Saunders, Bryce Johnston	Edmonton, Alta.	Oct. 17, '60	Nov. 16, '84	O.L.S.
Scott, Walter Alexander	Calgary, Alta.	Aug. 8, '85	Mar. 9, '09	A.L.S., S.L.S.
Seager, Edmund	Kenora, Ont.	Nov. 22, '38	April 14, '72	O.L.S.
Segré, Beresford Henry	Davidson, Sask.	Feb. 19, '86	May 8, '12	
Seibert, Frederick V	Rush Lake, Sask.	Nov. 5, '85	Mar. 11, '11	O.L.S.
Sewell, Henry DeQuincy	Toronto, Ont.	April 18, '48	May 16, '85	O.L.S.
Seymour, Horace Llewellyn	Red Deer, Alta.	June 11, '82	Feb. 22, '06	O.L.S., A.L.S., S.L.S.
Shaw, Charles Æneas	Greenwood, B.C.	Nov. 16, '53	May 10, '80	O.L.S., B.C.L.S.
Shepley, Joseph Drummond	N. Battleford, Sask.	Sept. 13, '79	Mar. 12, '06	S.L.S.
Smith, Charles Campbell	Vancouver, B.C.	Jan. 1, '73	Feb. 22, '06	O.L.S.
Smith Donald Alpine	Regina, Sask.	Sept. 22, '80	April 21, '10	S.L.S.
Smith, James Herbert	Edmonton, Alta.	Nov. 9, '76	Feb. 23, '05	A.L.S., O.L.S.
Soars, Henry Martin Robinson	Edmonton, Alta.	April 22, '77	Nov. 2, '08	A.L.S.
Speight, Thomas Bailey	Toronto, Ont.	Feb. 8, '59	Nov. 16, '82	O.L.S.
Starkey, Samuel M.	Codys, N.B.	Sept. 4, '37	April 14, '72	P.L.S. for N.B.
Steele, Ira John	Ottawa, Ont.	April 6, '81	April 16, '08	O.L.S.

APPENDIX No. 10—*Concluded.*

LIST of Dominion Land Surveyors who are in possession of Standard Measures.—*Concluded.*

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Stewart, Elihu	Collingwood, Ont.	Nov. 17, '44	April 14, '72	O.L.S.
Stewart, Lionel Douglas N.	Collingwood, Ont.	.....	Jan. 27, '10	O.L.S.
Stewart, Will Malcolm	Saskatoon, Sask.	Nov. 26, '84	June 6, '07	S.L.S.
Stewart, Louis Beaufort	Toronto, Ont.	Jan. 27, '61	Nov. 22, '82	O.L.S., D.T.S. Professor of Surveying and Geodesy, University of Toronto.
Stewart, Alexander George,	Edmonton, Alta.	Aug. 16, '87	Mar. 14, '10	A.L.S.
Stewart, George Alexander	.....	.....	April 14, '72	O.L.S.
Stewart, Norman C.	Ottawa, Ont.	Jan. 9, '85	March 7, '12	
Stock, James Joseph	Ottawa, Ont.	Aug. 16, '87	March 2, '10	
Street, Paul Bishop	Toronto, Ont.	Dec. 3, '81	Mar. 29, '10	
Stuart, Alexander Graham	Buckingham, P.Q.	July 16, '88	May 9, '11	
Summers, Gordon Foster	Haileybury, Ont.	.....	Oct. 20, '10	O.L.S.
Swannell, Frank Cyril	Victoria, B.C.	.....	May 10, '04	B.C.L.S.
Taggart, Charles Henry	Ottawa, Out.	..... '83	May 9, '11	
Talbot, Albert Charles	Calgary, Alta.	April 5, '56	May 13, '80	A.L.S.
Taylor, Alexander	Portage la Prairie, Man	Aug. 6, '75	June 9, '04	M.L.S., S.L.S.
Taylor, William Emerson	Owen Sound, Ont.	Aug. 3, '81	Dec. 16, '10	O.L.S.
Teasdale, Charles Montgomery	Concord, Ont.	Oct. 18, '79	March 9, '06	
Thompson, William Thomas	Grenfell, Sask.	Nov. 1, '53	Nov. 19, '77	D.T.S., S.L.S.
Tipper George Adrian	Brantford, Ont.	July 25, '86	May 18, '11	
Tracy, Thomas Henry	Vancouver, B.C.	June 25, '48	April 14, '72	O.L.S., B.C.L.S.
Tremblay, Alfred Joseph	Les Eboulements, P.Q.	.....	Feb. 18, '90	
Tremblay, Albert Jacques	Edmonton, Alta.	July 25, '87	March 1, '12	A.L.S.
Turnbull, Thomas	Winnipeg, Man.	May 26, '57	Mar. 29, '82	O L.S.
Tyrrell, James William	Hamilton, Ont.	May 10, '63	Feb. 16, '87	O.L.S.
Underwood, Joseph Edwin	Saskatoon, Sask.	Nov. 3, '82	May 18, '11	S.L.S.
Vaughan, Josephus Wyatt	Vancouver, B.C.	Oct. 17, '45	June 11, '78	B.C.L.S.
Vicars, John Richard Odlum	Kamloops, B.C.	April 16, '55	May 17, '86	O.L.S., B.C.L.S.
Vickers, Thomas Newell	N. Battleford, Sask.	April 19, '90	May 17, '12	
Von Edeskuty, Joseph Otto	Vancouver, B.C.	Oct. 27, '84	March 3, '13	
Waddell, William Henry	Edmonton, Alta.	March 23, '83	Mar. 25, '07	O.L.S., A.L.S.
Waldron, John	Moosejaw, Sask.	Aug. 1, '72	April 2, '07	S.L.S.
Walker, Claude Melville	Guelph, Ont.	Oct. 16, '84	Mar. 11, '11	
Wallace, James Nevin	Calgary, Alta.	Aug. 21, '70	Feb. 20, '00	O.L.S., A.L.S.
Warren, James	Walkerton, Ont.	Nov. 7, '37	April 14, '72	O.L.S.
Watt, George Herbert	Ottawa, Ont.	Feb. 5, '76	Feb. 24, '02	
Waugh, Bruce Wallace	Ottawa, Ont.	March 24, '88	May 28, '12	
Weekes, Abel Seneca	Edmonton, Alta.	Feb. 17, '66	Feb. 11, '92	A.L.S., S.L.S.
Weekes, Melville Bell	Regina, Sask.	Nov. 28, '74	Feb. 18, '03	O.L.S., S.L.S.
Wheeler, Arthur Oliver	Sidney, B.C.	May 1, '60	Nov. 21, '82	O.L.S., B.C.L.S., M.L.S., A.L.S.
White-Fraser, George W. R. M.	Victoria, B.C.	..... '61	Feb. 21, '88	D.T.S., B.C.L.S.
Wiggins, Thomas Henry	Saskatoon, Sask.	Aug. 24, '63	Feb. 18, '96	O.L.S., S.L.S.
Wilkins, Frederick, W. B.	Norwood, Ont.	June 27, '54	May 18, '81	O.L.S., D.T.S.
Wilkinson, William Downing	Not known	.....	Feb. 22, '93	
Williams, Guy Lorne	Enderby, B.C.	March 3, '79	June 24, '08	B.C.L.S.
Wilson, Reginald Palliser	Winnipeg, Man.	July 9, '72	Jan. 26, '11	M.L.S.
Woods, Joseph Edward	Pincher Creek, Alta.	Oct. 13, '61	Nov. 14, '85	A.L.S.
Young Walter Beatty	Winnipeg, Man.	July 6, '80	Mar. 25, '05	M.L.S.
Young William Howard	Calgary, Alta.	June 8, '78	May 17, '07	A.L.S. District Engineer

REPORTS OF SURVEYORS

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GENERAL REPORTS OF SURVEYS

1912-13

APPENDIX No. 11.

ABSTRACT OF THE REPORT OF J. R. AKINS, D.L.S.

BASE LINE SURVEYS IN PEACE RIVER DISTRICT.

I reached Edmonton on February 16, 1912, and having organized my party and shipped my supplies I left on the 26th for the Peace river district, the scene of my survey operations.

The route followed was by way of Grouard, Sturgeon Lake, Grande Prairie and Pouce Coupé district.

As the Canadian Northern railway was not yet completed to Athabaska Landing we went north by trail. There was very little snow, and the horses had hard work to pull the almost empty sleighs. A wagon was hired to help us as far as Athabaska Landing, where we took to the ice. From there the trail was fine and the ice in good condition so that we had good travelling as far as Pouce Coupé, where we arrived on March 23.

For the last few days the snow had been going very fast and the day following our arrival at Pouce Coupé it had almost all gone. Wagons were used for another ten miles and then we had to resort to our pack train. The spring is, without doubt, the best time for getting into this country. Work was commenced on the twentieth base line on April 3, and the west boundary of the Peace river block was reached on July 3. The country passed through was rough and hilly and consequently the work proceeded slowly, the levelling being especially difficult.

The month of June was very dry and we had considerable trouble getting observations, as there was much haze and smoke.

After completing this work we left for the twenty-third base line. Peace river was crossed at Fort St. John by swimming the horses and putting the outfit over in boats.

Work was commenced on the base line on July 27 and the sixth meridian was reached on September 4.

Very little horse feed was found along this line and on one occasion the pack train had to go fourteen miles from camp in order to get feed.

The fall of 1912 was exceedingly dry in this district, and the many fires which broke out caused much anxiety and trouble. As many as nine fires were counted around us at one time, and on one occasion we had to fight fires night and day for three days in order to save the horses and outfit. The country was burned over for more than one hundred miles north of Dunvegan.

The sixth meridian was corrected between townships 88 and 84, after which work was commenced on the twenty-second base line. After running fifteen miles of this line we came to burnt country and were forced to quit on account of not being able to secure horse feed. As there was yet no snow or ice, however, we were unable to leave for home. It was then the middle of November, and as snow might come at any time it was decided to do some outline work in the district not burnt over, while waiting.

On December 1, it began to snow and turned cold, the temperature falling to 30 degrees below zero. On the 5th we started for home, having run over one hundred and fifty miles of line during the season.

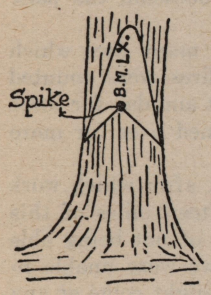
On December 6 a 'chinook' wind took away nearly all the snow. However, some ice was still left on the roads and on this the sleighs slipped fairly well, so that we were enabled to reach Grouard on the 14th. After doing a couple of days' work there,

ascertaining the area of land in some fractional quarter sections, we started for Edmonton, where we arrived on December 24.

LEVELS.

Levels were taken along the base lines run during the season, the work being checked by a second line of levels. It was found necessary to resort to trigonometric methods for taking the levels along the twentieth base, as it was impossible to keep up the work with one level. Long sights were also taken across many of the deep valleys and ravines. Great care was used in taking these sights. The instrument was set up at one side of the valley and ten or twelve readings were taken by means of the target on the other side. The positions of the rod and level were then reversed and readings taken the opposite way. The extremes of a set of readings would be about one-tenth of a foot. The mean of each set were taken as the correct reading. The instrument was tested before and after each set was taken and the necessary correction, together with the correction for curvature and refraction, was applied. The readings to the west were taken in the morning about five o'clock, and those to the east in the evening after six o'clock. Sights of over a mile were taken in this manner and splendid results were obtained. The elevation of the bottom of the ravine or valley was obtained by running a single line of levels down one side or by reading angles with the transit.

Where the distance was too great to take sights in this manner, spirit levels were run all the way across, and where the slopes were not too steep these were checked by another line of spirit levels; where steep slopes were encountered they were checked by trigonometric levelling. The transit used for this purpose had a six-inch vertical circle graduated to 0.004 degrees (about 14 seconds). No sights were taken longer than five chains. The distance was obtained by holding one end of the chain at the axis of the transit, with the other at the centre of the target, and a strong pull was put on the chain. The two verniers were read with the telescope both direct and reversed, and the mean taken. For each slope two sets of triangles were taken as a check on each other, and remarkable results were obtained, especially when done on cloudy days, in the early morning or in the evening, and we had no trouble in checking within the limits of one-tenth of a foot to the mile. On the other lines, no difficulty was found, as the country was not rough.



Bench marks were made at intervals of about one mile. These were made on large boulders or rocks, or where these could not be found, by driving a spike into a tree and making a blaze above it with the letters "B.M." and the number cut on it as shown by the diagram.

Where a rock or large boulder could not be found within four miles of the last one used, a permanent bench mark was made by bending an iron post about six inches from the end, digging a hole and planting the post with about ten inches showing above the ground. The elevation recorded was the top of the iron post, and in the case of the bench marks on the trees it was the top of the spike.

CHAINING.

Every precaution was taken to obtain accuracy in the chaining. The chains were tested by comparison with the standard supplied by the Department, the test being made in the following manner:—

A straight log of over a chain in length was chosen on which the standard was laid and subjected to a tension of twenty pounds, and a length of one chain was marked on the log. The chains used in chaining on the line were tested by this length giving them also a twenty-pound pull, and each one hundred links or sixty-six feet was tested separately. In practice, the chain was cleared so as to have no bends in it and a pull of about twenty pounds put on it before the distance was marked by dropping a narrow brass plumb-bob. Each half mile was checked separately, the first chainage being done with a four or five hundred link tape, the second with a three hundred foot tape. This eliminated the chance of any error of an even number of chains being made in any chainage.

Both front and rear chainmen carried clinometers with which they read the slope, and each recorded his own readings. At the end of the half mile each worked out his slopes independently. If the results obtained by each were nearly the same the mean was taken as the right slope correction for the first chainage. The same procedure was followed in the second chaining, and if the two chainages checked to within a link the post was planted at the mean of the two results thus obtained.

In the hilly country I consider two clinometers very necessary in chaining, one being used as a check on the other. Clinometers are liable to get out of adjustment sufficiently to make a considerable error in the work. Several times during the season I found it necessary to readjust the ones we were using and one was discarded altogether as it would not remain for any length of time in adjustment. If only one clinometer be used it may be considerably out without being detected unless the angle is also read with the clinometer in reversed position.

APPENDIX No. 12.

ABSTRACT OF THE REPORT OF C. F. AYLSWORTH, D.L.S.

RESURVEYS IN MANITOBA.

I left home on April 23, 1912, organized my party at Winnipeg, and proceeded to township 18, range 1, east of the principal meridian, where I was to make some resurveys.

In this and the surrounding townships the soil is of good quality, but surface stones, principally limestone, are numerous, and the land is very wet. A good quality of lime can be produced from the limestone, and when the land is drained and the stones removed the soil will be first-class for farming purposes. Timothy and clover grow well, and the vegetable products of the district cannot be excelled. Last year a considerable amount of wheat was shipped from Inwood, a station on the Canadian Northern railway.

Having completed the resurvey work in township 18, range 1, on June 5, I left the following day for township 16, range 6, and did some retracement survey near the mouth of Brokenhead river. Most of the lines I retraced in this locality lie in the drowned lands and lagoons on the south shore of lake Winnipeg. The depth of water varies with the direction of the wind. When the wind blows from the north and west down the lake, the water is forced over the land to a depth depending on the velocity and duration of the wind. Brokenhead river can then be navigated for a few miles up-stream from its mouth. When the wind is in the opposite direction the flat-bottom stern-wheel boats which ply these waters are frequently compelled to "stand off" for days awaiting a sufficient depth of water to enable them to cross the shifting sandbars which lie at the mouth of the river.

A branch of the Canadian Northern railway is now under construction from Winnipeg to Balsam bay, which lies a few miles easterly from the mouth of Brokenhead river. This branch runs through country which is mostly muskeg, and in order to secure a solid road-bed the railway company dug large ditches on both sides of their right of way. These ditches drain the land through which the railway runs, and carry an immense volume of water to lake Winnipeg. Extending from the mouth of Brokenhead river easterly to Balsam Bay is a splendid bathing beach. The bottom consists of a velvety sand, and the depth of the water within ten chains of the shore, does not reach the average height of a man. This beach, with its background of balsam and spruce on the uplands, would make an ideal location for a summer resort.

I finished the work in this locality on July 3, and left for township 25, range 6, east of the principal meridian, which lies on the north end of Hecla island in lake Winnipeg. For half a mile inland on this island the land is high and dry, and was at one time heavily wooded with poplar, spruce, birch and balsam. This strip has been recently overrun by fire, and it was somewhat difficult to locate the old survey monuments. The soil is sandy loam, stony, and underlaid at a depth of one to six feet with stratified shaly limestone. Farther inland is a low tamarack and spruce muskeg which will be valueless when the timber is removed.

The settlers, all of whom live on the strip along the shore, are of Icelandic descent, and live by fishing, though farming to a very small extent is practised.

On the east side of the island, in section 27, a large gang of men are employed in a limestone quarry, which is well equipped with modern machinery, and large quantities of stone for building purposes are conveyed on barges to Winnipeg. Many

quarry claims are staked out in sections 13 and 24, where it is intended to operate another quarry. Gull harbour on the east coast is becoming popular as a summer resort, and the establishment of a Dominion fish hatchery there renders it more important.

Wild raspberries grow on the island in great profusion, and no doubt fruits of many varieties would thrive. On an adjoining island silica sand has been discovered, and it is used extensively at the Beausejour glass factory to manufacture a very clear grade of glass.

On August 29 this work was finished, and I left by steamer for Selkirk, and thence to townships 22 and 23, range 5, west of the principal meridian. Nearly all the land in these townships is taken up. The surface is low and wet; about one-third is muskeg, and most of the remainder is poplar brulé, with considerable stone on the surface. The soil is very rich, but extensive drainage operations are necessary to make good farming land. A fairly large amount of green timber grows in township 23, but very little is found in township 22.

The Oak Point branch of the Canadian Northern railway crosses the southwest quarter of township 22, and some wheat was shipped from Ericksdale, a station in section 4. A passenger train service was inaugurated on this line a few days before we left the district, and the trains were loaded with passengers. This hitherto avoided portion of Manitoba appears to be coming into prominence.

As the ground was exceptionally late in freezing, I did not close operations until December 2.

APPENDIX No. 13.

ABSTRACT OF THE REPORT OF P. R. A. BELANGER, D.L.S.

MISCELLANEOUS SURVEYS AND INSPECTION OF SURVEY CONTRACTS IN MANITOBA AND EASTERN SASKATCHEWAN.

Before commencing my field operations I examined the iron posts made by the Taggart Ornamental Iron Works, of St. Boniface. On April 18, 1912, I left for the inspection of contract No. 5 of 1911, comprising township 39, range 4, and townships 39 and 40, ranges 5, 6 and 7, west of the second meridian.

Owing to slow progress, caused by the heavy rains which prevailed in May, rendering the roads impassable and making the rivers too deep to ford, this work kept us busy until May 20. These townships are accessible from Sturgis and Preeceville, by wagon roads leading from these stations along Lilian river into valley of Etomami river which runs northerly in range 5 to near the centre of township 40, where it is joined by Piwei river. From the junction of these rivers the road turns westerly along the north side of Piwei river and, meandering across the northern part of townships 40, ranges 5, 6 and 7 in the direction of Piwei lake, branches southwesterly in range 8 towards Nut Lake settlement, which is accessible by two different branches of the road after Piwei river has been crossed.

The country covered by this contract is rather bushy, except the part lying north of Piwei river, which has been considerably opened by fires, and where large tracts of land are ready for immediate settlement. A small cattle ranch owned by a Mr. White is located in the valley of Piwei river, in township 40, range 7, his cattle running all along the opening above described. He is at present at a great disadvantage on account of having to haul his hay supply a long distance over a rough road.

At the crossing of Piwei river, I entered contract No. 6, of 1911, where I inspected four townships. The country covered by this contract in ranges 8 and 9 shows a great improvement on that covered by the one just described; its character is generally rolling, open and well watered by numerous creeks, small lakes and sloughs, along and around which good hay is found in fair quantities. This country is reached by fairly good roads leading from Wadena and Tisdale railway stations through the settlements of Nut Lake, Farmingdale or Kelvington. These roads render this section very suitable for immediate settlement.

On June 10, having completed the work I had to do in Saskatchewan, I proceeded to Wadena where I shipped my outfit by rail, and boarded the train for Winnipegosis, reaching there on the 15th, after a stop-over at Dauphin for two days awaiting train connection.

From Winnipegosis, my party drove to Camperville and thence to township 35, range 21, west of the principal meridian, for the inspection of contract No. 4 of 1911, while I myself made a flying trip to Oak Point settlement for the purpose of hiring a boatman to bring my sailboat from that place to Winnipegosis. On my return to Winnipegosis I found my sail-boat had not yet arrived owing to the lack of wind to sail her up against the current of Waterhen river. I therefore despatched a small gasoline boat to bring it into the harbour, and on its arrival next day, I sailed to Camperville where I met my party which had just completed the inspection of two townships. On the following morning, after loading the camp equipage on the boat, I sailed to Duck bay. We camped at night on the bank of Insect river, in township 37, range 20. From this camp I made the inspection of that township, together with a traverse of part of Duck bay and, after another short move of camp northerly

G. H. Herriot, D.L.S.

Loading Dog Sleighs on Moose Lake, Manitoba.

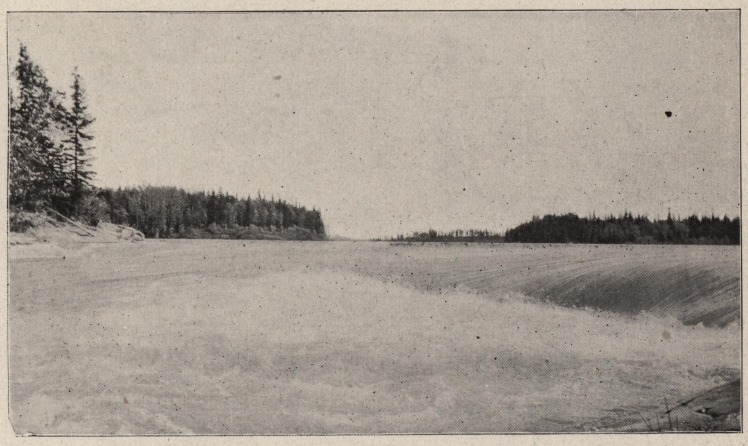


Photo. by G. H. Herriot, D.L.S.

Rapids on Nelson River above Cross Lake.

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along the bay shore, I completed the inspection of this contract in township 38, range 20. Judging from the part examined, the country included therein is very low and wet, and practically unfit for settlement; it consists mostly of tamarack swamps or bare boggy muskegs; a few small dry elevations, where small farms could be established, are found in township 35, range 21, along the stream known as North Duck river and also in township 37, range 20. In the latter township there are numerous good hay marshes where quantities of hay can be secured, but the great drawback is the lack of proper roads, the only good way to reach the district being by the water route from Winnipegosis or Camperville. As a compensation for all these inconveniences, intending settlers would have the prospect of making money in fall and winter time with the fish and fur trade which is still remunerative.

On July 12, having completed the inspection of contract No. 4, of 1911, I returned to Camperville. My assistants and some of the party took the outfit by trail to Winnipegosis, while I, with a few men, sailed to the same place with the remainder of the baggage, reaching there on the morning of the 16th. After disposing of my boats, I left on the next day by train for Portage la Prairie, whence I drove to township 14, range 6, for the purpose of making resurveys at the south end of lake Manitoba. However, after a trial on two different lines, I found it impossible to proceed with the work as the water in the lake was two feet higher than usual, and the whole land to be surveyed was flooded to such a depth that I had no other alternative than to postpone this work until winter.

From this place I drove to Oak Point and once more put my outfit on the train to reach contract No. 2, of 1911, in township 28, range 8, where I arrived on the 24th. Here the party was busy until August 12, inspecting four townships of the contract. These townships may be described as generally level, with a few small ridges. The land is fairly good and well interspersed with hay marshes, supplying all the hay necessary for a large settlement. The northern part of township 29, range 8, is partly covered by lake St. Martin, which abounds with good fish, such as whitefish, pickerel, pike and gold-eye. All around this lake is found a large belt of fine hay land which renders this township very desirable for cattle raising on a large scale. The Canadian Northern railway crosses this contract in ranges 8 and 9, thus affording great advantage to the settlers who were already coming in at the time of the inspection.

On August 13 we boarded the train with the outfit for Pleasant Point, a station on the Canadian Northern railway in township 10, range 13, west of the principal meridian, for the purpose of resurveying part of township 8, range 12. My work there was limited to the resurvey of sections 27 to 34, inclusive, where all marks were found obliterated. I also retraced the lines and restored the monuments marking the east boundaries of sections 3, 10, 15 and 22, and connected the same with the resurvey of the east boundary of section 27. In this township all the available good land and other resources have been disposed of.

In the beginning of September, while my assistants and party were continuing the subdivision survey in the township above referred to, I went once more to Clandeboye bay where, after procuring the services of an experienced canoeman of St. Mark, I spent three days running picket lines in townships 14, ranges 5 and 6, to temporarily mark the boundaries of the Kirchhoffer Shooting Club property until a regular survey could be made on the ice. This work was caried on with success, and I believe it answered the purpose of defining the boundaries of the property for the protection of the game on account of the intended visit of His Royal Highness the Duke of Connaught to this shooting ground.

From Pleasant Point, my next move was towards Prince Albert, which place I reached by rail on September 14, but the outfit did not arrive until the night of the 16th, and could not be unloaded from the car before the next day. From there, after securing my supplies, I proceeded northerly to inspect contract No. 18, of 1912, which kept me busy until October 2. This contract covers townships 54 to 56, range 1, and

township 56, range 2, west of the third meridian. These townships are rather heavily timbered, principally along the parts adjoining the timber berths. The country is hilly in the vicinity of Spruce river, which flows southerly across the three townships of range 1, draining townships 55 and 56, ranges 1 and 2, where the divide and height of land appears to run in a southwesterly and northeasterly direction. In township 56, range 2, the Prince Albert Lumber company have cut a short channel to divert a creek emptying into Montreal lake and bring its waters southerly into Spruce river, which empties into Saskatchewan river.

After completing this contract I undertook a seven days' journey to reach contract No. 20, of 1912, which, though only about eighteen miles west of contract No. 18, was accessible only by a circuitous route of over one hundred miles by way of Sturgeon lake, McOwan, Mount Nebo, Boutin and Big River. This contract covers townships 56 to 58, range 6, and townships 56 and 57, range 7, west of the third meridian. These townships are situated at the height of land on the north side of the divide and are mostly covered with timber, but fires have run over the country and made some openings in range 7. The land is fair, but it is badly broken by lake Delaronde and by numerous other lakes and muskegs. A few settlers have already forced their way into this country, which, on account of its close proximity to Big River village offers some opportunities for the sale of their products.

The village of Big River is situated in the southwest corner of township 56, range 7, at the south end of Cowan lake. It is now the actual terminus of a branch of the Canadian Northern railway. The Big River Lumber company owns the greater part of the village, besides large sawmills, where hundreds of men are employed all the year; so that settlers taking land near Big River will always be sure to find work at the sawmill when not working on their homesteads, and also a market for their products.

From this place, I returned to Prince Albert by rail, and then drove about fifty miles northeast to contract No. 17, of 1912, which covers townships 52 and 53, ranges 19 and 20, west of the second meridian. The road I followed to that contract passes through Henribourg settlement, and then turns east to a small Galician settlement where I struck a new road cut out a few years ago by the Hudson Bay and Pacific Railway company, and which runs across three townships of this contract. This whole road is very primitive and rough, and needs great improvement, but it is the only one by which this country can be reached.

Leaving this place, I reached the adjoining contract No. 16 by following a road cut easterly by the contractor who, I am informed, also cut another road southerly to Fort à la Corne.

Judging from what I have seen, very little land in these two contracts is fit for settlement, though the country has been much opened by fire. It is generally low and covered with numerous swamps or muskegs which were flooded by the heavy rains prevailing during last summer. The only place where homesteads could be found is along creeks, where tracts of fair land are met with, and where enough hay is found to permit of mixed farming. The draining and opening of this country might improve it to a great extent, and a dry season would also present it in quite a different aspect.

The chief aid in the development of this country will be the construction of the Hudson Bay and Pacific railway, the location line of which runs in a northeasterly direction across townships 52 and 53, range 20, and township 53, range 19.

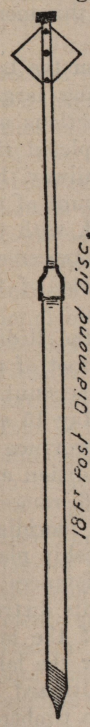
On November 7, having completed my inspection, I returned to Prince Albert *via* Henribourg, where I delivered my transport outfit to Mr. B. Nicholson for wintering. This journey was accomplished under great hardship, through snowstorms which lasted during two days, leaving eighteen inches of snow on the ground and covering the little grass or hay that was to be found along the road.

From Prince Albert I went to Hudson Bay Junction, a station on the Canadian Northern railway, where I spent five days surveying a few lines in connection with

timber berth No. 1920, situated in township 44, range 4, west of the second meridian. I then resumed my journey *via* Winnipeg to Cypress River, a station on the Souris-Arcola-Regina branch of the Canadian Pacific railway, for the purpose of traversing Assiniboine river across township 8, range 12, west of the principal meridian, which work had been omitted at the time of resurvey. After the completion of this survey, I returned to Winnipeg, where I discharged my party on November 30, postponing once more the survey required in townships 14, ranges 5 and 6, west of the principal meridian, owing to the fact that this marshy country was not yet frozen. I attended to this work with my assistant and a few men that I had hired on the spot, at St. Mark. I succeeded in retracing all lines, and re-established the monuments that were missing.

As this land, as well as the adjoining country, is mostly all covered with deep water or long reeds, and is owned by hunters who are anxious to protect their game against trespassers and poachers, I marked it with special iron posts, some sixteen feet and others eighteen feet in length, and generally showing about six feet above water, or a couple of feet above the reeds. The posts placed at corners in deep water are eighteen feet long and were driven from five and a half to seven feet into the ground. One post, marking the northwest angle of the reserve on lake Manitoba beach, is only six feet long, and will show three feet above the ground.

All posts on the side lines are surmounted with heavy diamond-shaped sheet iron plates with fourteen-inch sides which are painted red. They are attached by three rivets, and placed in the direction of the lines. The two posts marking the southeast and southwest angles have plates fourteen inches wide and twenty-four inches long bent in the middle at right angles to indicate the direction of the lines from the corners. Six inches below the plates are found the figures '$\frac{1}{4}$' or the section number indicating the corner which the post is intended to mark.



These posts are made in two pieces. The lower part is ten feet in length in the sixteen-foot posts, and twelve feet in length in the eighteen-foot posts, and is made of iron tubing one inch inside diameter. It is plugged and sharpened at the point, and threaded at the upper end. The upper part is six feet in length and is made of half-inch tubing, threaded at both ends. The two parts are fastened together by a connection which is adapted to the two sizes of tubing. A cap screwed on the top of these posts, and below the cap the plate above referred to, is attached by means of three rivets.

These posts are sufficiently noticeable to be seen by anybody and to prevent all trespassing. They should last for half a century, if properly cared for by the land-owners.

In the course of my travels in Manitoba and Saskatchewan I noticed the great movement which is going on in colonization, and which is increasing steadily year by year. The new settlers follow the trend of surveys, and were met with everywhere.

Small and large game appears to be nearly as plentiful as in the past, nothwithstanding the great slaughter which occurs every year, and fish are abundant in all the waters.

No minerals were found during the course of the season's surveys.

Lumbering is still carried on on a very large scale in the Prince Albert district, where hundreds of men are employed the year round by the different companies.

Railways are extending in all directions and prove a great blessing to the settlers, as well as assisting in the development of the country.

APPENDIX No. 14.

ABSTRACT OF THE REPORT OF G. A. BENNETT, D.L.S.

MISCELLANEOUS SURVEYS IN MANITOBA AND EASTERN SASKATCHEWAN.

These surveys varied greatly in character. They consisted in locating and correcting, where possible, errors in previous surveys, destroying duplicate monuments, restoring obliterated monuments and re-establishing lost monuments, traversing lakes, the boundaries of which have changed since the previous surveys, completing parts of subdivision and connecting surveys omitted by the original survey, and also investigating various errors which had been reported to the Department by settlers.

On account of the expense in travelling the long distances between the different surveys, I was accompanied on this work by only one assistant. Labourers were engaged locally when necessary and wherever possible. Most of the surveys were made in the bush country, and men were readily secured as needed, except during the harvest season, when farmers were offering labourers $7 per day to work in the wheat fields, and every man who desired work was employed. A detailed account of the surveys made is as follows:

On May 5, 1912, I arrived at Togo, Sask., and began the season's surveys. A few miles from this growing village, a large discrepancy had been reported to exist in the original survey. By retracing, I found a considerable error in the position of one of the boundary monuments and, upon petition of all the owners of lands affected, this monument was destroyed and a new monument erected at the true corner.

This district has made great progress during the last five years. When the land was first homesteaded progress was slow on account of the country being largely covered with scrub, but to-day the bluffs have disappeared from many sections and large quantities of wheat and oats are grown for export. Having completed this survey on May 8, I travelled to McCreary by the Canadian Northern railway, but found it impracticable to make the required surveys in this district, on account of the flooded condition of the country. I therefore proceeded to Sandy lake and, with the aid of a rented canoe, was able to complete, in a couple of days, the retracement surveys required to obtain the information necessary to correct the returns of the original survey of township 18, range 20, west of the principal meridian.

During the month of May, it was very rainy in the district about the Riding mountains in northern Manitoba. Large areas of the level country at the foot of the hills were flooded to an unusual depth, making the trails impassable. On account of these conditions, I travelled around to the east side of lake Manitoba on May 15 and found that the heavy rains, which were flooding the western part of the province of Manitoba, had not extended east of the lake. The trails were in fair condition and rapid progress was made in resurveying some lands in townships 15 and 16, range 4, and retracing parts of townships 21, ranges 4 and 7, west of the principal meridian. The purpose of these surveys was to make possible the issue of correct township plans showing the present shore of lake Manitoba and the true bearings and distances of section lines not correctly returned by previous surveys. As the land in this district rises gradually from lake Manitoba, a small change in the water level of the lake greatly alters the shore line. As meadow lines of considerable value border the lake, errors in the survey are of importance. These hay meadows have been utilized by small ranchers for the last twenty years, but it is only recently that the timbered country back from the lake has been settled. The branch of the Canadian Northern railway from Winnipeg to Gypsumville has opened up this district and as the main

roads are cut out and graded across the numerous muskegs, the homesteaders are getting better communications with the small villages springing up along the railway. Thus encouraged, the settlers are busy clearing up their homesteads, and already many fields of wheat and oats were noticed, but mixed farming is now, and will be, the staple industry here. The winter fishery on lake Manitoba is also a profitable employment for many of the settlers, while the numerous moose and elk provide food for the settlers in the newer districts.

On May 29, I completed these surveys and started for Norquay, Sask. Near this growing village I surveyed two lakes in township 34, range 1, west of the second meridian, which had been overlooked when making the original survey. This district has made rapid progress during the last few years. Graded roads extend miles from the railway, and rural telephones are found in the homes of most of the settlers. Formerly the land was covered with poplar scrub, but to-day many large fields of cultivated land are found, with numerous granaries, attesting to the productiveness of the clay loam soil.

The next survey was made in township 33, range 19, west of the principal meridian, to investigate a reported duplicate monument. I reached this work, after a two days' drive north from the town of Winnipegosis over a poor trail, which follows up to the west shore of lake Winnipegosis. Locating the duplicate monument on the flood land near the shore of lake Winnipegosis, I performed the necessary retracement, destroyed the false monument and renewed the true monument. The settlement north of the town of Winnipegosis is restricted to the lands near the shore of the lake, as the interior consists of a muskeg, which will have to be drained before the land becomes of agricultural value. However, the settlers are fairly prosperous. During the summer, they are employed in mixed farming, while the winter fishery affords them a ready market for their produce and profitable employment at the time of the year when the prairie homesteader has nothing to do.

June 22, I began a retracement survey in township 6, range 14, west of the second meridian, near the town of Weyburn, Sask., where large errors were found in the original survey. These discrepancies between the true acreage of the sections and that indicated by the titles were causing severe losses to unsuspecting buyers of land in the township. This district is undulating prairie. The land was homesteaded about fifteen years ago, and to-day the farmers have good roads, rural telephones, fine houses and outbuildings. The bountiful harvests of wheat have rendered them well-to-do within a few years.

On July 1, I visited township 31, range 31, west of the principal meridian, and made a resurvey to locate the southeast corner of this township, which is made fracional by the Coté Indian reserve. Most of the land in this district has been homesteaded by Galicians. Isolated from towns by almost impassable roads, these people live for a large part of the year on the produce of their cattle and poultry and their national black bread, and have become little Canadianized. However, the small clearings in the thick forest about their thatched log houses are being constantly increased, and soon it is hoped they shall secure schools, roads and the other advantages of civilization.

The retracement survey of part of township 21, range 14, west of the principal meridian, was next attempted. The dry weather had rendered the trails out of the village of McCreary now passable and the work was reached without much difficulty. As the original survey of this township was thirty-seven years ago, most of the monuments and marks left by that survey had disappeared and I found that all the homesteaders on the southeastern part of the township had located themselves erroneously and made their improvements upon different quarters than those which they had applied for. This is a severe set-back to the more enterprising settlers, as they lose the work of years in clearing and breaking the land, and have to move their buildings at a heavy expense.

This district is well adapted for mixed farming. This year a large drainage canal was dredged, which will dry up the muskegs and render the trails to the township more passable, as well as protecting the farmers from the floods, which in the past have reduced their activities to stock raising and lumbering.

On July 13, I began a retracement survey of part of township 18, range 10, west of the principal meridian. Three blocks were retraced before proper closings of the survey were obtained. Many of the monuments of the original survey were lost, and some of the homesteaders were so uncertain as to their location that they hesitated to make improvements. This country had been burned over several times and the land is easily cleared of the brulé and scrub which is left. The soil consists of sandy loam, somewhat stony in places. The large drainage ditches dredged this year will do much to dry up the many large muskegs, which render many homesteads difficult of access at present.

A restoration survey was next made, at the request of the Director of Forestry, of the boundaries of section 6, township 20, range 20, west of the principal meridian, in the Riding Mountain Forest reserve.

On August 10, I began a correction survey of part of township 14, range 4, west of the second meridian, petitioned for by owners of lands affected by mistakes in the original survey. The land surveyed consisted of rich prairie, a large percentage of which was cultivated and gave promise of a fine yield of wheat this season. This district has been settled twenty-five years and the farmers are well-to-do and have as fine houses and bank barns as may be seen in Ontario.

The next work consisted of investigating a lake in townships 5, ranges 15 and 16, west of the second meridian, which had been reported to have partially dried up. A survey was made to correct the original plan, so as to include the lands rendered of value by the drying up of the lake.

This township has changed lately from a ranching to a farming district. The soil, consisting of a heavy white clay with much of the humus burnt off, does not seem adapted to wheat growing, so the hay meadows around the lakes and sloughs are much sought after by the settlers to assist them in mixed farming.

Completing this survey on August 16, I returned to Manitoba and left the railway at Deer Horn siding on the Gypsumville branch of the Canadian Northern railway, to proceed to township 21, range 2, west of the principal meridian. By previous arrangement, a team and a driver met me at the siding and we set out at once for the work. This was necessary, as there is little settlement here near the railway. Following the trail by Vannes and the old surveyors' trails east, I had little difficulty in getting across the muskegs with a team to reach the work. Here some hardship was experienced on account of the rainy weather, as there was no settlement in township 21, range 2, west of the principal meridian and I did not carry around with me a regular camp outfit. However, I completed the surveys required, which consisted of destroying a witness monument incorrectly placed by the original survey upon the road allowance, and ascertaining the character of another monument incorrectly returned, together with the retracement of all connecting section lines.

As there is considerable hay in this district, a few ranchers could do well here, but several deserted shacks of homesteaders to be found in township 21, range 3, west of the principal meridian, show that the floods and bad roads in spring and summer render settlement difficult at present. It is probable that when the branch line of the Canadian Northern railway is completed north from Inwood that settlers will come into this country from the east.

The next survey made consisted in laying out the boundary of Dominion lands along the Dog Creek Indian reserve and the retracing of several section lines to effect proper closings in township 22, range 8, west of the principal meridian.

On September 11, I proceeded to Ingolf, Ont., and began the work of connecting the monuments on the interprovincial boundary between Manitoba and Ontario with

the monuments on Dominion lands in townships 9 and 10, range 17, east of the principal meridian. Very rough country composed of deep muskegs, cut by precipitous rocky hills, was encountered. As several men, whom I had expected to engage here as labourers, refused to work on surveys in this district for even $5 per day, I was further inconvenienced, and considerable time was spent in completing this work.

When retracing the interprovincial boundary across the National Transcontinental railway-right-of-way, I noted that the railway company has erected, for the information of travellers, a signboard to mark the dividing line between Ontario and Manitoba, approximately fifty yards west of the interprovincial boundary.

The rocky country along the Ontario boundary in townships 9 and 10 is of little agricultural value. Some of the few residents of the district find land suitable for potato patches, but they live by trapping, acting as guides to summer tourists prospecting, and doing assessment work on mining claims. Several small veins of auriferous ore were noticed. The value of the mineral deposits is as yet unproven, but the numerous moose, deer, ducks and partridges found here, indicate the value of the district as a hunting ground.

A small retracement survey was made in township 6, range 9, west of the principal meridian, to effect proper closings between two old surveys. Then on October 18, I travelled to Mistatim, Sask., and completed the survey of timber berth No. 1682 in townships 45, ranges 10 and 11, west of the second meridian. No settlements other than lumber camps are found in this district.

On October 29, I began the retracement of both sides of the fifth correction line through ranges 31, 32 and 33 west of the principal meridian. Here twenty-three duplicate monuments were found and destroyed. These false monuments had caused trouble among the farmers for many years, as they did not know which were the true ones, so could not open up the road allowances.

Large discrepancies in the old surveys had caused much trouble to the settlers in developing this district, but the farmers here were found to be in a prosperous condition; although wheat farming is the principal industry, much stock is also raised.

On November 20, I travelled to Sprague, in township 1, range 14, east of the principal meridian, to make a correction survey which the settlers had petitioned for. By retracing, I found a small error in the position of one of the monuments which was therefore destroyed and a monument erected at the true corner. This district is heavily timbered and the homesteaders are making slow progress in clearing their farms. Their principal income is derived from selling firewood, raising cattle, and trapping.

The next survey consisted in correcting the posting of a small parcel of land in township 26, range 6, west of the second meridian, so that proper letters patent could be issued.

On November 26, I began retracing section lines in townships 15, ranges 25 and 26, west of the second meridian. Although several duplicate monuments had been reported, only one was found, and this was destroyed. This survey ran through some of the premier farm lands of the West. Wheat growing is to-day, as twenty years ago, the principal industry of the farmers on these celebrated Moosejaw plains. They are among the most prosperous people in the West.

The next survey consisted in retracing a large part of township 14, range 5, west of the second meridian, to determine the compensating errors in the survey arising from a deficiency of seven chains in the boundary of one section. As soon as the farmers knew that there was sufficient land in the township to give each quarter a full acreage, fifteen owners signed a petition that the survey be corrected, but three owners of land affected by the correction survey, refused to have the boundaries of their holdings altered so no resurvey was possible, under the provisions of section 57 of the Dominion Lands Surveys Act. This is to be regretted, as the township is but little developed, the

improvements to be affected by altering the monuments being of little value, while the original survey will perpetuate very crooked roads and large inequalities in the acreage of the quarter sections in the township.

On December 13, I started from the town of Winnipegosis for Steeprock lake in township 30, range 15, west of the principal meridian. As lake Winnipegosis had now frozen over, I drove across the ice to Meadow Portage and then southeast across lake Manitoba to strike the Crane river trail, which took me just four miles south of Steeprock lake. From this trail, the lake was reached by following an old surveyor's trail. An investigation of the lake showed that large errors in the original survey necessitated a new traverse of the entire lake, which was accordingly made. No settlement was found in the vicinity of the lake, except a log cabin near a gypsum prospect on the south shore.

The next survey consisted of an investigation and survey of land around Shoal lake in township 18, range 2, west of the principal meridian. This lake is drying up very fast, and its topography has changed greatly since it was first surveyed. Large tracts of land shown under water by the original survey are now converted into valuable hay meadows, which are utilized by the neighbouring settlers. The apparent cause of the low water in this large lake is the unusually small precipitation in its drainage basin during the past four years. The lake has now no visible outlet, and its water has become so alkaline as to destroy the fish, which were very plentiful during the years of high water.

After taking some observations for azimuth in township 1, range 14, east of the principal meridian, the field work was completed on January 3, 1913, and I arrived home on the 7th.

During the course of the survey, ninety-two observations for magnetic declination were taken. These observations were obtained in forty townships, where miscellaneous surveys were being made, without materially retarding the work.

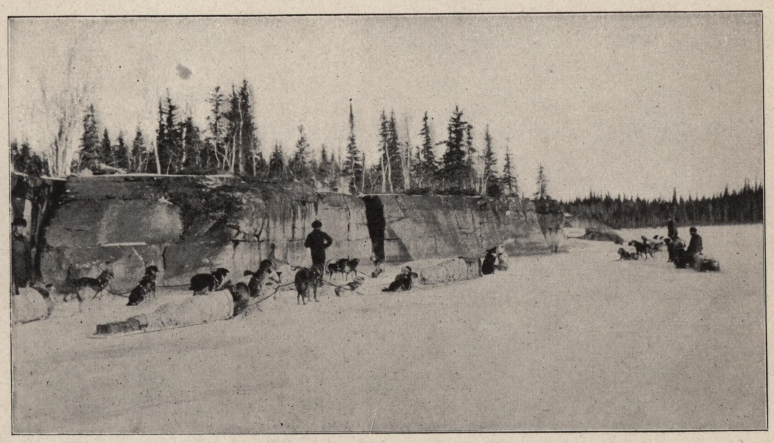


Photo by G. H. Herriot, D.L.S.
Dog Teams on Cormorant Lake.

Photo by G. H. Herriot, D.L.S.
Dog Teams on Cormorant Lake.

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APPENDIX No. 15.

ABSTRACT OF THE REPORT OF E. W. BERRY, D.L.S.

SUBDIVISION ALONG HUDSON BAY RAILWAY.

On June 16, 1912, I arrived at Winnipeg, where I spent a week outfitting and securing supplies.

I reached Pas on June 25, where I was delayed a week awaiting the arrival of freight. I then organized my party and proceeded with the survey of sections and the necessary outlines for three miles on each side of the Pas branch of the Canadian Northern railway, commencing at Pas and working southward. When the easterly portion of township 55, range 26, west of the principal meridian was completed, as it was found impossible to survey the east boundary of township 55, range 27, at this time, owing to floods, and the east boundaries of townships 53 and 54, ranges 26 and 27, until the extension of the fourteenth base line across ranges 27 and 26, the work here was discontinued and similar work commenced in townships 52 and 53, range 28, and townships 51 and 52, range 29, which occupied me until the end of October. At this date I returned to Pas, completed the subdivision of township 56, range 26, surveyed a parcel of land along Pasquia river in townships 55 and 56, range 26, and retraced the various blocks of Indian reserve No. 21 in this vicinity. The east boundary of township 55, range 27, was then completed.

The land traversed by the railway is spruce and tamarack muskeg, crossed by ridges covered with jackpine, poplar, and birch, but the timber generally is small. There is excellent gravel for road-making purposes on the ridges. The soil of the muskeg portions is a rich black loam covered with a foot of moss which prevents any run-off, and if it were removed and the land cleared, most of the land would probably be suitable for settlement without further drainage.

The only topographical feature of note is Pasquia river, the main stream of which rises in the Pasquia hills. The Turnberry branch, its principal tributary, crosses the railway in township 51, range 29, and joins the main river in a small lake about three miles north of the northeast corner of township 52, range 30. Both the main river and the Turnberry branch are fringed with poplar up to twelve inches and spruce up to twenty-four inches in diameter, suitable for pulpwood, lumber, and railway ties. The river is navigable for small steamers in summer, but is nearly dry at low water in winter. Stretches of land lie along its banks near its confluence with the Saskatchewan which produce a very fine crop of hay, but are flooded part of the season. There are good vegetable gardens on the Hudson's Bay company's property at Pas, and on some of the river lots. Grain has also been grown on these lots with satisfactory results, and the sectionmen at Westray and Turnberry sidings cultivate small gardens successfully. Strawberries and raspberries grow wild in great profusion along the railway track and dry ridges, rivalling the garden varieties in size.

Lumbering is the occupation of a large number of men in the district. The mills at Ruby lake, a few miles north of Hudson Bay Junction, and at Chemong, near the thirteenth base line, draw their raw material from adjacent limits. There is also a large saw and planing-mill at Pas, the logs being procured, for the most part, from limits up Carrot river.

During last summer the streets of Pas were cleared and graded, and sidewalks laid. The number of buildings in the town was doubled, and the lumbering industry, town improvements and railway construction promise to furnish employment for every available man for some years.

By the courtesy of Mr. M. H. MacLeod, general manager of the Canadian Northern Railway company, I was enabled to use a push car and velocipede for transporting my supplies and equipage along the railway, which greatly facilitated the work.

On completion of the surveys in townships 55 and 56, range 26, west of the principal meridian, at the beginning of December, I secured five teams of dogs. When these were equipped and broken to harness I proceeded across Saskatchewan river, completed the subdivision of township 57, range 26, part of townships 58, ranges 26 and 25, and the whole of township 57, range 25. I returned to Pas and paid off my party on March 17, 1913.

The land in these townships is rolling country covered with jackpine, spruce, tamarack, birch and poplar, with some extensive stretches of willow swamp. In many places, especially in the vicinity of the lakes, there are quantities of timber suitable for pulpwood and milling purposes. Reader lake, an expansion of Saskatchewan river, and Watchi lake, in township 57, range 26, are shallow and marshy. Atikameg lake averages fifteen feet in depth, and the water is clear and fresh. For some years the lake has produced over forty tons of whitefish and trout annually, and shows no sign of exhaustion. The Hudson Bay railway crosses township 57, range 25, diagonally in a northeasterly direction. The bridge across the Saskatchewan is nearly completed, and steel will probably be laid across this township early next summer. A winter trail extends from Pas to Atikameg lake, and a summer trail passes through the Indian reserve. The latter is passable as far as Watchi lake, but is in bad repair the rest of the way. Atikameg lake can also be reached by water through Moose lake and Cormorant lake.

In the swamp sections the soil is a rich black loam, which would prove very fertile if drained. Much of the dry portions of these townships is covered with jackpine and shows outcrops of limestone, indicating a soil somewhat light and shallow for farming. There are, however, several sections in township 57, range 25, timbered with small poplar which should make good agricultural land.

APPENDIX No. 16.

ABSTRACT OF THE REPORT OF G. H. BLANCHET, D.L.S.

SURVEY OF PART OF THE NINETEENTH BASE LINE WEST OF THE FOURTH MERIDIAN.

An early start for this survey was considered advisable, as much of the trail into the work ran through muskegs and over lakes. We started, therefore, as soon as the party could be reorganized after the completion of the twenty-third base line, leaving Athabaska Landing, March 22, 1912, and travelling by way of lac LaBiche and Heart lake. We reached our cache at Ipiatik lake in township 72, range 7, west of the fourth meridian on March 30, and on April 1 we moved by a new trail to a point three miles west of the northeast corner of section 36, township 72, range 6, the end of the previous line. The following day the line was picked up and range 6 started.

The height of land between Athabaska river and Hudson Bay drainage basins descends on its westerly slope in a series of ridges, broken by muskegs, and then drops in a well-defined escarpment, having a north and south course, to a fairly level country covered principally by muskegs and burned jackpine ridges. The base line left the rolling country of the height of land near the northeast corner of section 35, range 6.

In the first three miles of range 7, the line crossed a ridge of jackpine and poplar, extending from the northerly side of Ipiatik lake and running in a southeasterly direction.

Ipiatik lake, lying in the westerly part of range 7, is approached through a very wet tamarack muskeg. It is about two and a half miles across at its greatest width. The ridge forming the north shore of the lake swings off in a southwesterly direction along the course of Ipiatik river. The winter dog-trail to McMurray crosses the lake, running in a northeasterly direction. This route would not be feasible for a summer road, but could easily be opened up into a sleigh road.

The country north and northwest of Ipiatik lake, extending almost to the twentieth base line, is covered principally by muskegs, from which the drainage to the north flows into Christina river and to the south principally into LaBiche river and ultimately by both these channels into Athabaska river. This piece of country has probably small agricultural value, but, in conserving the water supply for the country north and south of it, it serves a useful purpose.

In range 9, several small muskeg streams unite in the vicinity of the base line to form Clyde river which, after making a detour to the north in ranges 10 and 11, crosses the base line on the westerly side of range 11, where it is about forty feet wide, five feet deep and flows through a willow bottom in a wide valley about one hundred feet deep, in which there are good hay lands. It continues in a southerly direction finally emptying into lac LaBiche.

In the middle of range 12, a large stream, which rises in the high land to the northwest, crosses the base line and joins Clyde river about seven miles south of the line. A good pack trail, running from lac LaBiche settlement to McMurray, follows along this river, striking off in a northeasterly direction about five miles north of the line.

In range 13 and most of 14 in the vicinity of the base line the country is principally muskeg, broken by brulé, jackpine and poplar ridges. To the north a rising sandy upland, covered with small second-growth jackpine extends for about ten miles, where the country rises more sharply into a poplar-covered highland. This extends west to Athabaska river. It reaches a maximum elevation in range 16, from where it becomes lower and broader as it approaches the river.

Two large streams in range 14 flowing from the north unite in the vicinity of the base line to form Wandering river. It follows along the base line to the middle of range 16 where it swings off to the north, returning and re-crossing in range 17. From there it strikes off in a southerly direction to LaBiche river. This river, with its tributaries, rising in the hills to the north and in the rolling poplar ridges to the south, affords drainage to the country between Clyde and Athabaska rivers.

The survey lines of the proposed Alberta and Great Waterways railway cross the base line in the western part of range 15, running in a northerly direction.

Between Wandering river and Athabaska river the country is principally muskeg, extending as far as the hills to the north and south nearly to LaBiche river.

Athabaska river crosses near the centre of range 18, having a general north and south course. The valley is about one mile in width and varies from 400 to 600 feet in depth. The river at that place flows at the rate of about three and a half miles an hour, and is navigable for boats of small draught for a considerable distance up stream and down stream as far as Grand rapids.

West of the Athabaska the country is high and slightly rolling, rising to the north towards the Pelican mountains, while to the south it becomes lower and forms an immense muskeg, extending to Calling river. Streams from the north are numerous. These crossing in range 19 lose themselves in the muskeg, but those farther west unite in three principal streams, and empty into Calling lake. Some good hay sloughs and agricultural lands of excellent quality are to be found along these streams. Some patches of good spruce were found in range 19, along the course of the Athabaska.

Calling lake, which has an area of seventy-five to eighty square miles, was crossed by the line near the northerly end, most of range 22 and part of 23 being in the lake. Its length from northwest to southeast is about fifteen miles and its maximum width about seven miles. The country to the north and northeast drains through it into Calling river, which leaves it in its southeast corner and flows in a southerly direction into the Athabaska. Abundance of good whitefish are taken from this lake every winter and shipped to outside points by way of Athabaska Landing.

A well-pronounced ridge, for the most part heavily timbered with spruce, poplar, and birch up to thirty inches in diameter, extends along the southwesterly side of Calling lake, becoming high and rough in the vicinity of the base line in ranges 23 and 24.

Athabaska river, from its crossing in range 18, proceeding upstream, continues in a southerly course to Athabaska Landing, where it swings around to the north and approaches within three miles of the line in range 24, where it again swings off to the south. All this portion of the river is navigable. The country north of the river is composed of rolling poplar ridges, separated by strips of muskeg. Fawcett (formerly Moose) lake, in range 26 just north of the base line, is about eight miles long and varies from one-half to one mile wide. Fawcett river flows from its west end and empties into Lesser Slave river. There is a depression extending northeasterly from Fawcett lake which is chiefly muskeg; north of this the country rises towards the Pelican mountains.

APPENDIX No. 17.

ABSTRACT OF THE REPORT OF L. BRENOT, D.L.S.

SUBDIVISON SURVEYS IN THE PEACE RIVER BLOCK.

I left Ottawa for the scene of my season's operations on February 8, 1912. A few days were spent at Edmonton in organizing my party, and on the 22nd we left for Fort St. John, B.C., travelling by Athabaska Landing, Grouard, Peace River Crossing, and thence up Peace river on the ice as far as Fort St. John.

The trip from Edmonton to Fort St. John took only thirty-five days, six of which were spent at Dunvegan waiting for my provisions which had been delayed on the journey up. Mine were the first teams to take the ice trail westerly from Dunvegan. I found the ice up to Fort St. John in good condition, and experienced no trouble whatever. I believe, moreover, that it is worthy of note, that the state of the ice will permit travelling without risk until April 5 of any year. Hay and oats had to be carried from Dunvegan, as there are neither settlers nor stopping-places between there and Fort St. John.

On April 1 the subdivision of township 84, range 19, west of the sixth meridian, was commenced, and township 84, range 18, and parts of townships 83, ranges 18 and 19, were subsequently surveyed.

Fort St. John, an old Hudson's Bay trading post, established in 1830, is situated in sections 18 and 17, township 83, range 18, on the north side of Peace river. Revillon Bros. also have an outpost at this place. The Roman Catholic Church and the Church of England have mission houses in the district, but both have been closed for the past few years.

Mail service was opened last summer between Beaverlodge and Fort St. John, proving a great boon to settlers and others in that remote part of the country. The establishment of a telegraph service between the same points is expected within a couple of years and when this is done it is intended to cut a wagon road from Pouce-Coupé prairie to Fort St. John. The road from Pouce-Coupé prairie to Beaverlodge is already opened, and has been used for the last two years.

The country surrounding Fort St. John is well drained by the Peace and North Pine rivers and the Stoddart and Montagneuse creeks. The valley of Peace river has an average width of two miles, and a depth of eight hundred feet. The river itself has an average width of twenty-five chains and a depth of not less than four feet at low water in its shallowest parts. North Pine river is a stream about four chains in width; it also runs through a valley nearly eight hundred feet deep. The hills on the northerly side of both these rivers are almost prairie land and are as good for grazing as any lands in British Columbia or Alberta. Throughout the winter these hills are wind-swept and are thus kept clear of snow. In spring, therefore, the sun takes effect on the ground long before the snow has even melted on the plains. The result of this is that vegetation springs up fully two weeks earlier than elsewhere. Ranching has been carried on successfully, as stock can range all winter with practically no loss; farming conditions are very favourable, good grain has been grown, and the gardens at Fort St. John have produced all kinds of vegetables.

After completing the subdivision in the vicinity of Fort St. John, I proceeded to Hudson Hope, following the pack trail on the north side of Peace river. About fifteen miles west of Fort St. John we passed 'Jim Rose' prairie. This is a small stretch of fertile country about four miles long by two miles wide. Two squatters here had

beautiful gardens under cultivation, and I afterwards learned that they had had great success with their vegetables, as they were unhampered by summer frosts. About twelve miles west of this place, at the meeting of Peace and Halfway rivers, another small settlement was encountered. The squatters here had been industrious, and great improvements were evident. The potatoes they had grown were the largest and finest I had ever seen.

We arrived at Hudson Hope on August 6, and proceeded next day with the subdivision of parts of townships 81, ranges 25 and 26, west of the sixth meridian, completing this work on October 11. Statutory declarations were taken from thirty-two settlers squatting in these two townships.

The Hudson Hope trading post in section 18, township 81, range 25, was previously situated on the south side of Peace river, but in 1900 it was moved to the north side, opposite its old site. A short distance northeasterly the country is suitable for ranching and farming. Furthermore, it may be reasonably believed that in the near future Hudson Hope will be one of the important towns of the North; it is the head of navigation, untold mineral wealth lies untouched in this vicinity, vast coal fields have been discovered to the west and adjoining the block, and huge water-power is within easy reach.

After completing the above-mentioned work, a large raft was built and we floated down the Peace as far as Halfway river. I here surveyed the east outlines of townships 84, ranges 22 and 23, and the south boundary of township 84, range 22, all west of the sixth meridian, with the intention of subdividing the flat adjoining this meeting of the streams. Owing to the floating ice it was impossible to complete the blocks of two sections, as prescribed in the Manual, by producing the lines across the river, so I therefore closed operations for the season on November 9. Two days later we started on the homeward journey and reached Fort St. John on the 12th. Five days were then spent repairing the outfit, shoeing horses, and bringing provisions up the hill from the Fort. The journey was then resumed and it took until November 20 to get everything across North Pine river. Then two days had to be spent baling hay which had been previously cut.

During all these preparations the 'chinook' winds had been playing havoc with the snow, not leaving enough for sleighing. I made good use of the delay thus caused by starting the subdivision of township 84, range 17, and worked until November 28. A blizzard raged all the following day, and after this we were able to move on once more.

Although heavily loaded and travelling through an unbroken country, we reached Peace River Crossing, a distance of 225 miles, in twelve days. This overland trail is almost a natural road, no work beyond opening being done, yet travelling on it is much easier than on some of the roads in daily use. In ten days we accomplished the journey from Peace River Crossing to Athabaska Landing and there we boarded the train for Edmonton, where I stored my outfit and paid off my men on December 26.

APPENDIX No. 18.

ABSTRACT OF THE REPORT OF M. P. BRIDGLAND, D.L.S.

TRIANGULATION SURVEYS IN THE RAILWAY BELT OF BRITISH COLUMBIA.

Preparations for the season's survey were begun on May 3, 1912, and after making a survey of some villa lots at Banff, we left Calgary on May 9, reaching Salmon Arm in the railway belt on the 13th.

The time from May 14 till June 10 was spent on work around Salmon Arm. Two new stations were established, "Bastion" on a shoulder of the Bastion mountains five miles west of Sicamous, at an elevation of about 4,200 feet, and "Armstrong" on a burnt ridge about six miles east of Armstrong railway station, at an elevation of 5,300 feet. The latter station lies nearly a mile south of the southern limit of the railway belt at this point. In addition to the above, a third station was established on a high peak in township 18, range 13, west of the sixth meridan. Of these stations, Bastion is the only one permanently marked.

Angles were read at both ends of the Salmon Arm base and at Ida, Granite, Fly hill and Bastion. All of these stations are easily reached, and no description of the routes followed is necessary. In addition, some work was done on the Salmon Arm base. The main camp was situated near the centre of the base, and any time not otherwise utilized was spent clearing the line.

On June 11 the party moved from Salmon Arm to Malakwa, at the base of Queest mountain. A light camp was taken to timber-line just below the summit, though, owing to the large quantities of snow still remaining, considerable difficulty was experienced in finding a suitable camp ground. Then the weather changed, and for some days nothing was visible but snow, rain or fog.

On the 16th and 17th the weather cleared, the work was completed, and camp moved down to the valley. The temperature on the 17th was 103 degrees Fahrenheit in the shade, and although the descent was not difficult all members of the party were nearly exhausted on reaching the main camp.

On the 19th the main camp was moved to Revelstoke, and in the evening a light camp was brought back to Three Valley to climb Griffin mountain. In order to avoid excessive heat the climb was started that evening, and a point about 800 feet above the valley was reached. During the night a very high wind blew down a large stub which fell about two feet away from the side of the tent. This, combined with an uncomfortable bed, helped us to get an early start the next morning. At noon camp was pitched a short distance below the summit, and in the afternoon a set of angles was read. The following day smoke was so dense that further work was impossible, consequently the signal was re-erected, and the party returned to Revelstoke.

At Revelstoke Mr. McDiarmid's longitude station was located, and the angle at that point between mount Mackenzie and mount Begbie was read.

It was then decided to establish a station near the south limit of the railway belt, west of Columbia river. The party crossed the river at Wigwam, and then crossed a low divide between there and the bend of Cranberry creek. The left bank of the stream was followed till the first large stream entering from the west was reached. Camp was pitched about four miles up this stream, and the station was established on a peak about 9,000 feet above sea-level, and lying almost directly south. Angles were read, the station permanently marked and a cairn erected, although some severe thunder-storms caused a hasty retreat from the summit on more than one occasion. There is much large timber through this section, chiefly cedar

and hemlock, but much of the country is so rough that it would be a very difficult matter to get it out.

Up to this time, plans formed during the early part of the season had been fairly well carried out, but here all work was disarranged, and remained so for the rest of the season. From June 28 till July 15 all instrument work was impossible owing to rain and clouds, and the only work done was to move camp from Revelstoke to Albert Canyon, by the Canadian Pacific railway, and thence by pack-train up the north fork of Illecillewaet river to "the farm." A light camp was pitched at timber-line below "Cornice," and on July 15 an attempt was made to read angles. Work in this valley was completed on July 18.

Mount Bonney was the next station on the list, but by the time Albert Canyon was reached, smoke was so dense that work there was considered impossible. Consequently the party returned to Revelstoke and ascended Mount Mackenzie. The distances from there to the longitude station at Revelstoke and to Mount Begbie were short, but it was only with difficulty that the signals could be seen.

After the work was completed on Mount Mackenzie, the rain began again. Consequently the party started for Mount Carnes signal near the north limit of the railway belt. This is the same mountain that has been called Mount Serenity by Mr. Howard Palmer. The route taken was the same as that followed in 1910. Angles were read at the signal, the station permanently marked, and the cairn rebuilt. A set of photographs was taken at the signal and two secondary stations were occupied. The whole trip took eight days, only three of which were fine.

The remaining stations to be reached from Revelstoke were Mount Bonney, Mount Albert and Mount Begbie. These ascents were all made by the same routes as in 1911. In each case several days were lost through bad weather, and it required twenty-two days to make the three climbs.

The party then moved to Enderby and thence to Mount Mara signal in the Hunter range. Sixteen days were spent on this trip, twelve of which were stormy. Angles were read and an azimuth observation taken.

On September 11, the party started for Mabel Mountain, following the same route as in the previous year. This trip was made in five days, during which a complete set of angles was read and an azimuth observation taken. During the other four days the party travelled fifty miles by pack-train, eight miles by boat, packed camp on their backs for twelve miles, and climbed 5,500 feet.

On September 17, word was received that Mr. C. De la Condamine was waiting at Salmon Arm to commence work on the base line, and the day following the party moved over to the Arm. Angles were re-read at the ends of the base and at Mount Ida and Granite Mountain. Several attempts were made to get an azimuth at the south end of the base but, owing to clouds and excessive refraction, no satisfactory results were obtained. All triangulation work was completed on September 30.

On September 19, two men were placed at Mr. De la Condamine's disposal to assist in preparing the line. These men remained with him except for two days while assisting on Granite Mountain. The other members of the party worked on the base line while not otherwise employed. The actual measurement of the base line by the invar wire was commenced October 7 and completed November 4, during which time four measurements were made. In addition to this the base was connected with several Dominion Lands posts. A full report on the measurements of the base is being prepared by Mr. De la Condamine.

It had been intended in the early part of the season to make a rough photographic survey of the country lying betwen the north fork of Illecillewaet river and Columbia river, an exceptionally fine alpine country. Owing to bad weather, it was soon found that this would be impossible. However, photographs were taken whenever it was possible to do so without interfering with the triangulation work. Unfortunately, these were nearly always taken in cloudy or smoky weather.

Photo by O. Rolfson, D.L.S.

Norway House.

Photo by F. V. Seibert, D.L.S.

Cache on Twenty-first base line, west of the Fourth Meridian.

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The season of 1912 was very unfavourable for any kind of topographical work. In addition to exceptionally wet and cloudy weather, smoke caused much trouble. Immediately after heavy rains, smoke or haze was sometimes so dense that it was almost impossible to see signals. From June 17 to 25, the weather was very hot, the temperature going as high as 103 degrees Fahrenheit in the shade at Revelstoke. From June 26 to September 8, usually the most favourable season of the year, there was rain or low clouds fifty-four days, and heavy smoke seven days, a total of sixty-one days out of seventy-six, and of the remaining fifteen hardly one day was actually clear of clouds or smoke.

MEASUREMENT OF THE SALMON ARM BASE—BY C. DE LA CONDAMINE, D.L.S.

The principle followed in the measurement was to lay down spans approximately twenty-four metres long and to then accurately measure these lengths with invar wires, the extremities of which are fitted with scales graduated in millimetres.

In order to measure a wire length or span, tripods were set over the extremities of each span, at a distance of approximately twenty-four metres; the head of each tripod bears a fine line which was placed by means of a plumb-bob over the extremity of the span. The wire was stretched between two tripods, the tension of ten kilograms being applied by two ten kilogram weights, one attached to each end of the wire by a cord which passes over a ball-bearing roller mounted on a special straining trestle. When properly placed, the graduated scales of the wire should lie against the bevelled heads of the tripods.

In December, 1910, at a temperature of fifteen degrees Centigrade, under a tension of ten kilos, the lengths of the wires were:—

No. 272.—24001.10 mm.
No. 273.—24000.94 mm.

The length at a temperature "t" is given by the formula:—

$L = 1\ (1 - 0.000\ 000\ 121t + 0.000\ 000\ 000\ 15\ t^2)$ where L is the length at t° Centigrade, 1 is the length at 0° Centigrade.

The length of the wires increases slowly in the course of time. The operation of annealing took place on February 15, 1908, and the wires were measured on December 19, 1910.

From February 15, 1908, to December 19, 1910, there are 1,038 days and from December 19, 1910, to October 6, 1912, there are 658 days, the total being 1,696 days.

According to data obtained from a study of the material of the wire

Lengthening, for 1,038 days from date of annealing 0.0094 mm.
Lengthening for 1,696 days from date of annealing 0.0112 mm.
Lengthening from December 19, 1910, to October 6, 1912=0.0018 mm.

This refers to a wire 1 metre long. For a wire twenty-four metres long the lengthening would be 0.0018 x 24 = 0.043 mm.

The length of the wire depends also on the temperature to which it has been subjected during the preceding two or three weeks. The mean temperature for two weeks previous to the measurement of Salmon Arm base, was + 11°.1 Centigrade. A special table gives for this temperature a lengthening of 0.009 mm.

On October 6, 1912, therefore, the lengths of the wires must be corrected by

$$0.043 + 0.009 = 0.052 \text{ mm.}$$

This gives:

No. 272 = 24 001.152 mm.
No. 273 = 24 000.992 mm.

These values have been taken as giving the lengths of the wires on October 6, 1912, at fifteen degrees Centigrade, and the formula of dilatation has been applied to them.

The base was marked out by Mr. M. P. Bridgland in 1910. It lies wholly in township 20, range 10, west of the sixth meridian, and is close to the town of Salmon Arm, B.C. The northeast end of the base is in section 24, the southwest end in section 5; both ends have been connected by traverses with the nearest section posts. The base has also been connected with the northeast corners of sections 10, 9, 4 and 5, also the quarter post on the east boundary of section 5, all in township 20, range 10, and the northeast corner of section 31, township 19, range 10.

Part of the line is in cleared country and part in wooded country. The ground was generally good, though a litle soft in some parts, and swampy along the edge of Shuswap lake. In soft ground the tripods were set on stakes firmly driven into the ground in order to avoid any possible disturbance during the measurements.

The party consisted of two observers, a recorder, a leveller, and five labourers, two of whom were in charge of the straining trestles, two carrying the tripods and one setting them over the hubs.

As the line was at some distance from beaten trails, the work was carried on in such a way that transportation of instruments was entirely avoided, the wires only being carried back to camp every day. The base was divided into seven sections, each section consisting of a number of wire lengths. Starting at the southwest end of the base a section was measured in a northeasterly direction, the same section was then measured in a southwesterly direction and again in a northeasterly direction. The next section was measured three times in the same way, and so on to the northeast end of the base. The fourth measurement was made continuously from the northeast to the southwest end of the base.

The work was performed in the same way as in the measurement of the Kootenay base, with some little changes because of the employment of a recorder and a leveller who had not been engaged on the Kootenay base measurement. The line was picketed every twenty-four metres, using a steel tape as the steel wire supplied with the apparatus did not give good results.

The tripods being set over the hubs, and the wire placed in position, a reading was taken by each observer, this sufficing to give the distance between the measuring marks on the tripod heads. The wire was then disturbed slightly, in order to overcome any friction of the cords or rollers and another pair of readings taken. Five such pairs of readings were taken and if the five resulting distances derived from these readings agreed within $\frac{3}{10}$ of a millimetre they were accepted. If there was a discrepancy of more than $\frac{3}{10}$ of a millimetre between any two determinations, further readings were taken, although this was seldom necessary.

The slopes between the tripods at the different hubs were entered in a special book, the hubs being numbered to avoid confusion between the different spans. The observers changed places at mid-day each day in order to correct for personal equation.

The line is generally level, although it is broken in some places by small ridges six or seven feet high. Great pains were taken in order to obtain a slope as low as possible. In order to obtain this it was generally sufficient to set the tripods at a suitable height. In some cases, however, it was found necessary to dig trenches or to set the tripods on hubs driven into the ground. With these precautions the slope was in most cases kept below one per cent. On four or five occasions it reached five per cent, on twelve occasions six per cent, on three occasions seven per cent and once nine per cent during the four measurements. It may then be expected that the error due to inaccuracies in measuring the slope will be very small.

The slope when small was read by a special level which may be mounted on an upright gudgeon on the chaining tripods to replace a target with which each tripod

is fitted, so that the axis of the telescope when levelled should be at the same height above the measuring mark on the tripod head as the middle line of the target. The eye-piece of the level telescope is fitted with a micrometer scale, each division of which corresponds to a slope of 1 in 1,000 at a distance of twenty-four metres.

The slope between the measuring marks on the heads of two adjacent tripods was then obtained at once by setting up the telescope on one tripod and reading off the position of the middle line of the target on the next tripod, on the micrometer scale.

The micrometer scale, having been obtained by a photographic process, is not very accurate, and it is necessary to make a small correction to each reading. In order to find the correction, two methods were employed:—

Firstly.—A rod graduated in centimetres was placed at twenty-four metres from the micrometer, and the division of the rod apparently in coincidence with each division of the micrometer was read. This method is not very accurate and does not give good results.

Secondly.—Two tripods were set at a distance of twenty-four metres. The difference of elevation of the two tripods was measured with a rod and an auxilliary level. Then the slope was measured forward and backward with the micrometer, and the mean taken. The result from the level being practically correct, this comparison gave the correction to the micrometer for the divisions used. By changing the difference of elevation of the two tripods the corrections were found for as many divisions of the micrometer as seemed necessary.

Very consistent results were obtained in this way, and showed that the micrometer could be used for slopes below four per cent. Above four per cent a special levelling was done.

The levelling was checked by the following method: At the beginning and at the end of each day's work a bench-mark was established and its elevation above or below the last tripod was measured. The readings of the micrometer giving at once the tangent of the vertical angle, by adding the tangents with their proper sign and multiplying the result by 24.000 the difference of elevations between the first and the last tripod was obtained and so the difference of elevation of the two bench-marks. When running the line again this elevation was checked and the discrepancy distributed. It was so small that it would not have appreciably affected the length of the line.

At the beginning and at the end of each day's work the first and last tripods were set over a fine mark which was left in the ground until the measurements were completed. Each tripod is fitted with a plumb-bob, the point of which is on the vertical passing through the mark of the tripod's head.

The setting of the tripods is generally very tedious, especially when there is a little wind. If the wind is too strong this method is entirely unsuitable and even when the air is quite still the error in setting cannot be expected to be less than ½ millimetre. For this reason the first and the last tripods were set over the marks by means of a transit. The transit being set up a few feet from the mark and at right angles with the line, the mark was sighted and the head of the tripod was moved until it came into coincidence with the cross wires, and the span was then measured; the process was repeated four times, twice circle right and twice circle left, making a new setting of the mark on the tripod head each time; the mean of the four measurements was taken. The plum-bob was used only to put the tripod on line. Generally, the mean of the first double measurement (circle right and circle left) agreed with the other within 2/10 of a millimetre. The error in setting was then negligible.

The length of the base is not an exact number of wire lengths, the last span from hub numbered 340 to A, the southwest end of base being about fifteen metres. This span was measured by triangulation and with a steel tape in the following manner: A hub numbered 341 was established beyond the end of base A and the distances 340-A and A-341 were measured with the steel tape. The span 340-341 was then measured

with the invar wires in the usual manner, and the difference between the measurements with the steel tape and the wires was distributed in proportion to the lengths 340-A and A-341.

To obtain the length of the fractional span by triangulation, two triangles were laid down, one on each side of the base, each of them having two sides equal to twenty-four metres and the third side being the fractional span A-340. The quadrilateral thus obtained had A-340 as one of its diagonals. The eight angles and the four sides were measured and the diagonal was calculated.

The results were:—

With the steel tape	14 923.205
By triangles	14 923.002
Difference	0.203
The mean	14 923.103

This mean has been taken as it does not appear from the measurements that one method is better than the other.

The transit used was a six-inch Watts, reading to 30″.

The weather was generally fair, though seven days were wet. When the rain was light some work was done, but it did not appear safe to work when the wires could not be kept reasonably dry, on account of the extra weight of the drops of water and of the stiffness of the cords passing over the straining trestles.

The range of temperature was from +1 to +24 degrees Centigrade, the largest correction for temperature for the whole length of the base was 7.084 mm., and the smallest correction 2.917 mm.

Taking into account the days or parts of days lost on account of bad weather, the four measurements lasted about seventeen days. The base being a little over eight kilometres this averaged a little less than two kilometres a day. It must be pointed out that the days were short and that it was often impossible to work after four o'clock.

The speed depended very much on the country, and, as a rule, where the country was open and flat the speed was almost twice as great as in wooded and rolling country. In all cases when measuring a base much better progress can be made as soon as the men become trained to the work.

The best speed was attained on October 22, when 110 spans or wire lengths were measured in seven hours and thirty minutes, the mean speed being about sixteen wire lengths or 389 metres per hour. The ground was rough at six of these spans which delayed the work considerably. The maximum speed reached during the whole measurement was twenty-seven spans (648 metres) per hour.

The rate at which this base was measured could not easily have been increased in flat and open country, but where the country was rough faster progress could have been made had eight tripods been available instead of six. With six tripods the method of procedure was as follows: While the front tripod was being centred the observers were taking their readings on the wire which was suspended between the next two tripods in the rear. The fourth tripod in the rear, that immediately behind the observers, was left untouched during these observations lest the observers should accidentally disturb their tripods before completing their readings. Meanwhile this tripod was sighted upon by the leveller, who had his level telescope mounted on the fifth tripod in the rear. The sixth tripod was being carried from the rear to the front, a distance of six spans, ready for centering.

When there was nothing to retard progress, the observers on finishing at one span moved on to the next, the front observer finding the tripod centered ready for him; the leveller moved up so as to leave but one unoccupied tripod between himself and the rear observer, the man engaged centering tripods moved ahead to prepare the next tripod for the front observer, and the man packing tripods made another trip. Should any one of these men be delayed, therefore, the whole party would be kept waiting,

whereas had eight tripods been available, the observers would always have tripods ready for them, and would suffer no delays.

In rough country the leveller had to use his auxiliary level to obtain the difference of elevation of two tripods, and this necessitated two settings of the level, as all work must be checked. A vertical circle fitted on the tripod level, graduated to give sufficiently accurate readings for slopes up to ten per cent, would obviate these delays, and the leveller would then be able to keep pace with the observers in rough as well as in level country.

In order to make a comparison of the lengths of the wires in the field, one of the spans was measured eighty times with each wire. The largest measurement with wire No. 272 was smaller than the smallest measurement with wire No. 273, the two measures differing by 11.273 mm., indicating probably that wire No. 272 was longer than its accepted length, or that wire No. 273 was shorter than its accepted length.

Comparing the two means of the eighty measurements, a difference of 0.207 mm. was found between the lengths of the two wires, wire No. 272 being the longer. The difference between their accepted lengths was 0.16 mm. It would seem, then, that there was an error of 0.05 mm. in one of the accepted lengths of the wires, and from this cause the results of the measurements of the base with the two wires should differ by 340 x 0.05=17.0 mm., wire No. 272 showing the base to be 17.0 mm. shorter than wire No. 273. The actual difference between the final results of the base measurement by the two wires is only 11.5 mm.

It must be pointed out, however, that a good comparison of the wires is impossible in the field, although from the results of the tests mentioned above, the error due to this cause would appear to be not much larger than the error of measurement.

The correction for the small difference in the intensity of the force of gravity at Salmon Arm and in France, where the tapes were standardized, was too small to appreciably affect the final results.

The mean elevation of the base above the sea-level is about 1,160 feet. Taking as radius of the earth 20,890,172 feet, the correction to reduce the base to sea-level is—453 mm.

The line was divided into seven sections. Comparing the two measurements obtained with wire 272 we have:

Section.	Spans.	Number of spans.	Discrepancy.
1	From 1 to 45	45	0·526
2	46 55	10	2·260
3	56 110	55	1·078
4	111 167	57	1·541
5	168 212	45	0·161
6	213 290	78	2·173
7	291 340	50	0·087
		340	7·826

When measuring with wire 272 the discrepancy was always in the same direction. The probable error of one measurement due to the observing errors only,

$$=0\cdot477\sqrt{\frac{340}{7}\left[\frac{(0\cdot526)^2}{45}+\frac{(2\cdot260)^2}{10}+\ldots\ldots\right]}$$

$$=\pm 2.7 \text{ mm.}$$

Probable error of the mean $=\mp 1\cdot9$ mm.

Probable error of one span $=\mp 0\cdot14$ mm.

Wire 273 gave the following results:—

Section.	Spans.	Number of spans.	Discrepancy.
1	From 1 to 45	45	−0·223
2	46 55	10	+0·268
3	56 110	55	−1·562
4	111 167	57	+0·655
5	168 212	45	+2·047
6	213 290	78	−0·455
7	291 340	50	+2·963
		340	+3·693

Taking the probable errors of the measurements only we have

Probable error of one measurement $= \mp 1{\cdot}9$ mm.

Probable error of the mean $= \mp 1{\cdot}4$ mm.

Probable error of one span $= \mp 0{\cdot}10$ mm.

The results for each section are given in the following tables:—

Section.	Spans.	Wire No. 272.		Wire No. 273.	
		Forward.	Backward.	Forward.	Backward.
1	1– 45	1,080,296·754	297·280	300·109	299·886
2	46– 55	240,048·075	050·335	049·780	050·048
3	56–110	1,319,664·034	665·112	668·152	666·590
4	111–167	1,367,685·079	686·620	687·083	687·738
5	168–212	1,080,043·766	043·927	043·531	045·578
6	213–290	1,872,124·618	126·791	126·875	126·420
7	290–340	1,200,309·338	309·425	309·685	312·648
		8,160,171·664	179·490	185·215	188·908

Wire 272 (mean)	8,160,175·577 mm.
Fractional span	14,923·103
Measured length of base	8,175,098·680
Correction to sea-level	453·
Final length of base	8,174,645·7
Wire 273 (mean)	8,160,187·062 mm.
Fractional span	14,923·103
Measured length of base	8,175,110·165
Correction to sea-level	453·
Final length of base	8,174,657·2

The mean of the two lengths was accepted as the true value of the base, so that

Accepted length of base at sea-level = 8,174·6514 metres.

APPENDIX No. 19.

REPORT OF J. A. CALDER, D.L.S.

SURVEYS IN THE RAILWAY BELT OF BRITISH COLUMBIA.

E. DEVILLE, ESQ., LL.D. ASHCROFT, B.C., February 12, 1913.
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following general report on my surveys in the railway belt of British Columbia, during the season of 1913.

After a few days devoted to getting my party and outfit together, I left Kamloops on June 7, and began the season's operations by making surveys required in the neighbourhood of Spence Bridge.

Lands in townships 16 and 17, ranges 24 and 25, were subdivided, and several Indian reserves and provincial lots tied in to the Dominion Lands system. Parts of the Thompson and Nicola rivers were traversed; the left bank of the former through township 16, range 25, was connected to such of the old survey monuments near the river as could be found, and these monuments were restored. Considerable difficulty was experienced in locating old corners, and many of the earlier survey monuments in the vicinity are lost.

The country in the neighbourhood of Spence Bridge appears to be particularly favourable to the production of fruit. Nearly all the varieties are grown with great success, as well as the ordinary field crops. This district, being in the "dry belt," requires irrigation, and frequently patches of good land lie unworked owing to the difficulty and prohibitive cost of getting water. Any ground in the dry belt, if not too elevated or physically unsuitable will, with water, unfailingly yield crops of all kinds in remarkable quantities and quality. In future, therefore, as land in general becomes scarcer and dearer, water will doubtless be brought to most of the lands which now lie idle for want of it.

On July 20, I moved to Canford, about twenty-eight miles up Nicola river, where I made some subdivision surveys and tied in a couple of Indian reserves.

The cultivable land in this district is well adapted for mixed farming, the elevation being about eight hundred feet higher than at Spence Bridge. I should judge that the more delicate varieties of fruit might not be a safe crop. In confirmation of this view I observed slight frosts early in August. The country generally, save for flats along Nicola river, is hilly and much of it is covered with fair timber, principally pine and fir. A saw-mill has been built on Spius creek, a couple of miles from Canford station, affording employment and a market for timber to many of the settlers.

A great deal of the best land along the Nicola valley is included in Indian reserves, and very little of it is cultivated. This is a condition general to the country, and it seems a great pity that where good land is so scarce so much of it is thus permanently idle.

Fram Canford I proceeded to Stein river to subdivide lands along its valley. This river flows from the west into the Fraser at a point about four miles above the town of Lytton. I found that for eight miles of its course the river flowed through a narrow precipitous canyon, so rough as to make it impracticable to carry on subdivision in the regular way. I accordingly located the section lines from a traverse run along the right bank of the river as far as the north boundary of section 28, township 15, range 28. Every north and south section line intersected was marked on the ground. The traverse was carefully checked by another independent traverse. From this point the canyon broadens into a valley which I subdivided for settlement as far as the centre of section 33, township 15, range 28.

In this valley, from about the east boundary of section 32, township 15, range 28, there is a narrow strip of good agricultural land as far as subdivided. This bottom land rarely exceeds a quarter of a mile in width, and is encroached upon in many places by ridges of rock debris. The sides of the valley rise abruptly in a series of

rock slides and unscalable cliffs. The low land along the river is covered with a dense jungle of red willow and other brush, interspersed with cottonwood of fair size, and occasional groves of cedar. The difficulty of opening survey lines through such profuse vegetation seriously hindered the progress of the work. The soil is generally a light sandy loam. The valley at this point is about 1,900 feet above sea-level, and appears to be free from summer frosts, the first observed being on September 19.

Owing to the thickness of the brush, it was almost impossible to see or to hunt any large game, although it was a common experience to hear a startled bear or deer crackling through the underbrush, and their tracks were everywhere abundant.

There is no trail passable for horses up Stein river, the chief obstructions being several slides formed by huge irregular masses of rock. The only present means of access to the valley by pack train is a long circuitous trail which leaves the Fraser at a point nearly twenty miles above the mouth of Stein river, and after three days' travel, leads into Stein valley in section 33, township 15, range 29, and continues up the valley for some distance. This trail can be used only for a few months in the summer as it passes over high mountain ranges and becomes blocked by snow early in the fall. It would be a costly undertaking to build a wagon road through the canyon, but a fair pack trail can be made at a reasonable expense. A road or trail of some sort must be built before settlement in the valley is practicable. The river, however, is navigable by canoes, and a road is not so immediately essential in the valley proper.

Stein river presents excellent facilities for the development of water-power. For about nine miles it is a continuous series of rapids, the fall averaging about one hundred and fifty feet per mile. An immense volume of water is discharged, but the quantity varies a great deal according to the season.

Having exhausted my supplies, I was obliged to discontinue my surveys in the valley on October 17, arriving in Lytton on the 19th.

I next made some surveys in township 15, range 26, including the traverse of both banks of Thompson river, through the east half of the township. There is but little land of value along the river in this township, as the country generally is very rocky and broken. Upon some small spots fruit is grown successfully. There are good flats on Botanie creek at an elevation of about 1,200 feet above the Thompson. The soil is a clay loam of good quality.

On November 13 I moved to Walhachin, where I was engaged until December 14 in subdividing lands in that vicinity, suitable for settlement.

There are considerable stretches of elevated open country to the south of the town, forming excellent range land. Most of it is hilly and broken up by gulches. The soil is generally a dark clay loam of fair quality, and some of the land could be tilled profitably were water for irrigation available. The greater portion of the good farming land in the immediate neighbourhood of Walhachin is controlled by English capital, much of which has been invested in the construction of reservoirs and flumes to store and convey the water for irrigation. The greater part of their water supply is obtained from Deadman river, which flows into the Thompson a few miles east of the town. Considerable areas have been planted with fruit trees, which are as yet too young to bear. The young orchards are all thriving, and give promise of abundant returns in the near future.

I finished the season's work by tying in a small Indian reserve in township 19, range 25, and on December 20, I arrived in Kamloops, where I stored my outfit and disbanded the party.

The season was very favourable, and little time was lost on account of bad weather. The fall was unusually mild and open.

I have the honour to be, sir,
Your obedient servant,
JOHN A. CALDER, *D.L.S.*

APPENDIX No. 26.

ABSTRACT OF THE REPORT OF A. S. CAMPBELL, D.L.S.

MISCELLANEOUS SURVEYS IN THE EDMONTON DISTRICT.

My first work for the season of 1912 was the resurvey of Lake St. Ann settlement.

I secured my outfit at Edmonton, where I experienced great difficulty in procuring horses owing to the great demand for them due to the large amount of railway construction work and the rapid influx of new settlers. We succeeded, however, in securing two teams, and on May 20 set out for Lake St. Ann settlement, where we arrived on the 23rd, having travelled over a road, many parts of which are about as they were in the days of Red River carts.

The resurvey of the settlement was begun immediately, but our progress was slow as the weather was very unfavourable for survey work throughout June and July, there being only four days in the latter month without rain. Almost every day we had heavy electrical storms, many of them the most violent I have ever experienced. Our progress was also hindered by the terrible condition of the roads and by the difficulty in locating the old monuments.

At Lake St. Ann is one of the very old posts of the Hudson's Bay company, and also an old established Roman Catholic mission. The annual pilgrimage to the latter is one of the chief events of the year. There are now three or four stores in the settlement, and during the past two or three years a small amount of farming has been done in the district. The coming of the main line of the Canadian Northern railway, which passes within about three-quarters of a mile of the village, will doubtless lead to a rapid advance in settlement. Much of the land in the district is of excellent quality, though still almost all covered with fairly heavy poplar and spruce, or with brulé and brush.

Lake St. Ann itself is a fine large sheet of water, affording an abundant supply of fish, chiefly whitefish and pike, many of the former being of exceptionally large size.

Most of the original owners of lots have sold their land and moved farther back and a number of the lots have been subdivided into building lots, the idea apparently being to establish Lake St. Ann as a summer resort.

The water in the lake was exceptionally high this year, a number of the original corners being now under two feet of water, and in some places the lake has advanced a hundred feet or more on the former beach. The height of the water is due partly to the very wet season, and partly to the damming up of its outlet, Sturgeon river, which, in many places is clogged with driftwood.

The land to the east of the lake is very rolling, and bears some large poplar timber, besides a considerable amount of very good hay and pasture. This should be an excellent stock-raising district.

Having completed the resurvey of the settlement on August 8 we set out for Edmonton, arriving there on the 10th. The roads were in many places almost impassable, being soft and terribly cut up by the heavy traffic due to the hauling in of railway construction supplies.

Passing through the St. Albert district we saw many excellent stock farms. The principal crops grown appeared to be oats and timothy, the railway construction causing a great demand for these commodities.

At Edmonton we spent three or four days in finding another team, after which we set out for township 53, range 21, west of the fourth meridian, where I was instructed to retrace the boundaries of sections 30 and 31. Having finished this work we left on August 24 for township 53, range 19, following the old base line road from Edmonton to Beaverhill lake district. This road has, since the operation of the Grand Trunk Pacific, fallen into disuse and is in bad condition, numerous culverts and small bridges having been burned out. The route followed took us across the Cooking Lake forest reserve. As a result of numerous fires, there is but little sign of any forest growth, especially in the southern part of the reserve.

In township 53, range 19, I found the lines very irregular and most of the corners lost altogether, as the fires had in many places burned from one to two feet into the soil. This township is very slightly settled, except in the eastern tier of sections, many of the former settlers having left when they were shut off on the west and south by the formation of the forest reserve. The land is quite flat in the eastern third of the township; the remainder is quite rolling, and contains many small lakes and sloughs, most of which, in ordinary years, produce large quantities of hay. This year, however, we found the water very high, and hay very scarce. The soil is an excellent quality of loam for the most part, except where the fires have burned down to the clay beneath, but practically the whole township would be vastly benefited by a system of drainage. This could be easily obtained through Ross creek, which empties into Beaverhill lake, and has an abundant fall in crossing the township. The settlement of this township has doubtless been much retarded by the lack of roads, the construction of which was delayed by the municipality till the position of the road allowances could be ascertained. Owing to the height of the water, I found it advisable to leave the traversing in this township till after the freeze-up.

On the completion of the mounding we left on October 28 for township 49, range 20. As there was a large amount of traversing to be done, the resurvey of this township occupied us till December 21. The township is almost all very hilly and very little of it is suitable for anything but stock raising. A few sections in the eastern and southern parts are fairly level. The soil throughout is good heavy loam. Some parts are covered with heavy poplar, but the township is largely burnt over and grown up with heavy brush.

Miquelon lake extends across the township in a southeasterly and northwesterly direction, cutting it almost in two. There are only about a dozen settlers in the township. They have done little clearing and are almost without roads, though, during the past fall, a start was made in this direction.

Miquelon lake being without an outlet is very alkaline, and contains no fish. Deer are fairly numerous, and ducks and partridges are found in thousands, both in this township and in township 53, range 19. Around Miquelon lake and the smaller lakes and sloughs in the township several thousand muskrats were caught during the past season.

The Tofield-Calgary branch of the Grand Trunk Pacific railway passes within a couple of miles of the east boundary of the township and the Camrose-Edmonton branch of the Canadian Northern railway at a slightly greater distance from the southwest corner, but as a considerable proportion of the land in the district is held at fairly high prices, settlement is slow while free homesteads can be had elsewhere. Practically all the settlers in this township are Scandinavians.

On the completion of the work in this township we returned to Edmonton, where I paid off the men on December 23.

After storing my outfit in the warehouse at Edmonton and providing for the wintering of the horses, I, with my assistant, returned to township 53, range 19, and completed the traversing in that township, arriving back in Edmonton January 2, 1913.

APPENDIX No. 25.

REPORT OF A. V. CHASE, D.L.S.

EXAMINATION OF LANDS IN KAMLOOPS DISTRICT.

ORILLIA, ONT., February 25, 1913.

E. DEVILLE, ESQ., LL.D.,
Department of the Interior,
Ottawa, Canada.

SIR,—I have the honour to submit the following report on the examination of lands in Kamloops district, British Columbia, during the season of 1912.

I left Orillia on May 18 and proceeded at once to Kamloops where I collected my outfit. On May 27 I sent my pack train overland, and proceeded myself by train to Ashcroft, where I assembled my party and then moved north via the Cariboo road as far as Bonaparte Indian reserve No. 3. Leaving the wagon road there I moved southwesterly by pack trail to camp near the south end of McLean lake in township 21, range 25, west of the sixth meridian, where I commenced work for the season.

Township 21, range 25, is chiefly remarkable for its great area of excellent grazing land, the value of the merchantable timber being secondary, and agricultural land being entirely absent. Nearly the whole northern part of the township is good grazing land, part of it being quite open and part of it covered with open timber and poplar groves. The eastern and southeastern part of the township is mountainous, and is covered with scattered pine and fir, some of which on the northern slopes in the northeast quarter of the township is of merchantable size and quantity. In general, the eastern part, however, is rolling, hilly land the chief value of which is for grazing purposes.

The southwestern part of the township is all timbered land, rising steeply to the southwest. The timber is fir and pine, and in some places it is of merchantable size and quantity.

On June 6 I moved camp westward from McLean lake into ranges 26 and 27 and commenced the examination of the valley of Hat creek and its branches. The work was continued south to within a short distance of the south boundary of township 19. As elevations of over 4,000 feet above sea-level were encountered there in the main valley, I decided to cease operations in that locality.

This area, comprising parts of townships 19, 20 and 21, ranges 26 and 27, appears to be an ideal stretch of country for the raising of cattle and horses. To the east and west of the main creek bottom lie excellent grazing lands to the extent of seventy-five square miles and upwards, and the main creek valley contains much excellent bottom land fit for hay growing. This bottom land is not open for settlement, being already settled and cultivated, but it is mentioned here to show the possibilities of the valley as a whole. South of the south boundary of township 21 fruit growing is not a success, but potatoes were found doing fairly well in the north part of township 19, at an elevation of about 3,700 feet above sea-level. This is an instance of how favourable local conditions may be for agricultural development, in spite of considerable altitude.

The amount of land fit for agricultural development in this valley, and still open for settlement, is extremely small. There is some land in the neighbourhood of the northeast corner of township 20, range 27, consisting of good workable soil, and at an elevation suitable for potatoes and the hardier vegetables, but an elaborate scheme

of irrigation would be necessary to water it. Small areas of workable land are also found in the eastern parts of townships 20 and 21, in range 27, and in township 21 range 26, all of which require irrigation. For any lands lying to the west of Hat creek there is an abundance of water for irrigation purposes, the streams flowing eastward out of the Clear mountains, in range 27, having generally a good flow of water. Lands to the east of Hat creek, however, would have to be irrigated from that stream as the small supply of water from creeks flowing westward through range 26 is all being used at present.

Timbered lands comprise most of the east halves of townships 20 and 21, in range 26, and all of townships 20 and 21, in range 27, except a strip of land from one to two miles wide adjoining the east boundaries in range 27, and extending as far north as the centre of township 21, which is fairly open within the area examined. The northwest quarter of township 19, range 26, contains a couple of square miles of fairly open land, but otherwise the township is timbered throughout. No stretches of timber of such quantity and quality as to be notably valuable for lumbering purposes were noted in this valley. Bull pine and fir are most in evidence, and many areas were noted where trees 24 inches in diameter on the stump are fairly plentiful, but either the locality or the quantity is generally unfavourable to profitable lumbering operations. Speaking generally, the purpose to which the lands in Hat creek valley are best adapted is stock raising.

On June 25, I moved eastward through townships 19, in ranges 26 and 25, to a point in section 22, township 19, range 25, and proceeded to examine the lands adjacent to this camp in range 25.

The only agricultural land noticed in the west half of township 19, range 25, consists of about forty acres in the valley of Oregon Jack creek about three-quarters of a mile from the west boundary of the township. This area is good bottom land fit for hay-growing, but it is very difficult of access. The remainder of the west half of the township is steep, rocky, timbered mountains. The east portion of the township is a rolling hilly country and is more or less timbered throughout those lands still undisposed of, the timber, which is chiefly bull pine and fir, becoming open and scattered toward the east of the township. There is very little valuable land left unsettled, except a small flat area consisting of light sandy loam soil in the eastern part of the township, but this would need abundant irrigation for cultivation.

The undisposed of land in township 20, range 25, is nearly all timbered country on the slopes of the Cornwall hills. A small area, which offers fair grazing and which is partly covered with scattered bull pine, rises to the north from the valley of Cornwall creek. The small portion of township 19, range 24, lying west of Thompson river, contains two areas of good bench land fit for fruit growing, one in section 18 and one in section 31. The remainder of the lands in this township open for settlement are of value for grazing purposes only.

On July 1, I moved into Venables valley in township 18, range 25, and on the 6th into Twaal valley in the same township, examining lands from Thompson river westerly.

The Crown Grant lots and the Indian reserves in these valleys were evidently laid out with care to include all the agricultural land possible. The result is that, with the exception of a couple of small triangular areas in the angles of the lot boundaries, no agricultural land remains undisposed of, and the only valuable parts left are grazing and timber lands. The heights between the two valleys offer a considerable area of good grazing land, particularly on the slopes adjacent to Twaal creek, and a good class of scattered fir and pine is found on the upper slopes and on the lands adjoining the creek in the northern part of the township. West of Twaal creek are found two areas of fir timber of merchantable size and quantity, in all about two square miles in extent, the remainder of the hills being covered with a small and scrubby variety of timber in the northern part and old burn in the southern part. The lands adjoining Thompson river are generally open and very rough. A small flat bench of gravelly

soil was found in the extreme northwest part of township 18, range 25, extending into township 18, range 26, but otherwise the only land of value is grazing land. The timber on the heights west of Venables valley is small and scattered. This valley is served by a good wagon road, but Twaal valley is accessible only by pack trail.

On July 10, I moved camp to Spence Bridge, and continued the examination of lands in township 17, range 25, and in the northern parts of townships 16, ranges 24 and 25.

The most of the land in township 17, range 25, consists of steep, rocky mountains, there being two summits in the western part rising to an elevation of over 5,000 feet above sea-level. The valley of Murray creek is a steep rocky gulch which widens out to an area of gently sloping land about the west boundary of the township, but this area is so difficult of access that it is of small value. Somewhat over 100 acres of good bench land was found adjoining Murray creek in sections 10, 15 and 16, at an average elevation of 2,000 feet above sea-level. This, with small acreages in sections 4, 26 and 34, makes up the agricultural land still open for settlement in this township. These lands are accessible at present by pack trail only. The areas adjoining Thompson river, both in the westerly and southerly parts, are open and semi-open lands, of use for grazing only.

Townships 16, ranges 25 and 24, west of Nicola river, are composed mainly of a range of hills the summit of which is like the Nicoamen plateau. Lands west of Thompson river in this township are all steep rocky side-hills, timbered with small and scattered fir and pine. The Nicoamen plateau proper is a rolling summit to which the land rises from Nicola river on the east and from Thompson river on the west. A number of small benches were noted on the slope adjoining Nicola river, and similarly on the slope facing Thompson river is found an area of about 200 acres of bench land, consisting of sandy loam and dark loam soils. Much of this land is at an altitude similar to that of the Rose hill district, and should prove productive under dry culture, while 75 or 100 acres of it are somewhat lower and would require irrigation. The lands in the lower levels near the rivers are fairly open, and offer good grazing areas on their north slopes. At an altitude of 2,000 feet above sea-level timber begins to be in evidence, and the summit is fairly well covered with fir and pine of medium size.

On July 17, I moved camp from Spence Bridge westerly through townships 16 in ranges 25 and 26, and camped at the south end of Botanie lake in township 16, range 26, from which point I examined lands to the south and north in townships 16 and 17.

The chief resource of township 17, range 26, is a large area of excellent grazing land. Botanie Indian reserve No. 15 was evidently laid out with the intention of including all the valuable land in the main valley, but there is still some good grazing land east of the reserve, particularly in the south centre of the township. The land in the north centre and the northeast part is extremely rough and in general timbered. It was not examined in detail. The northwest part immediately north of the reserve is also very rough, except for a small jackpine flat of no agricultural value.

Coming southward into township 16, range 26, little land of value is found, nearly three-quarters of the area of the township being composed of rocky mountains. The valley of Botanie creek, running from north to south through the western part of the township, is very narrow and steep, and only near the south boundary is any land found fit for agricultural purposes, and this does not exceed 100 acres. This land is found to be very sandy, and the adjoining land under cultivation requires an abundance of water for irrigation. Very little valuable land is found on the hills to the east and west of the valley. A strip of timbered land about one-quarter of a mile wide follows the creek bottom, and contains a quantity of pine, fir, hemlock and spruce fit for ties.

The importance of Botanie lake as a reservoir for irrigation purposes should be noticed here. In the spring of the year a great flow of water goes to waste through Botanie creek to the south, and Skoonka creek to the east, leaving the normal flow

of the summer season much below what could be utilized for lands in Botanie creek valley and along Fraser river in township 15, range 27. By means of a dam at the south end of Botanie lake and a creek diversion to bring the waters at present draining east through Skoonka creek into the lake, a supply could be obtained sufficient to irrigate all the agricultural land in these areas.

On July 23, I moved camp south into township 15, range 26, and continued examination of the lands in that township north of Thompson river and in township 15, range 27, east of Fraser river.

A great part of township 15, range 26, is composed of the rough rocky hills of the Scarped mountains. The valley of Botanie creek, in which lies practically all of the agricultural land north of Thompson river, is fairly well settled and very little of this land remains undisposed of. Small areas of dry sandy loam bench land are found north of the Thompson in sections 8, 17, 18 and 19 which, with abundant irrigation, would be suitable for fruit-growing. The timber in this valley is unimportant.

I next moved camp to a point in Spintlum Flat Indian reserve No. 3 in township 16, range 27, and on July 31 to a point in section 30, township 17, range 27, from which main camp I completed the examination of lands east of the Fraser as far north as the boundary of the railway belt.

Only a few scattered areas of bench land fit for agricultural purposes were found east of the Fraser in townships 15 to 18, inclusive. In township 15 range 27, all the workable land east of the river sufficiently flat for cultivation is contained in sections 24 and 25. About 150 acres are workable, but this land would require abundant irrigation as the soil is sandy and porous. The remainder of the undisposed-of land in this locality is composed of gravelly cutbanks rising steeply to rocky hills. In township 16, range 26, east of the river, the hills come down to the water's edge in the southern part but recede as one goes north to about one-half mile from the river's edge, leaving a small flat in the northeast quarter of section 4, and small benches in the west half of section 16, the northwest of section 21, and the southeast quarter of section 32. None of these areas is in itself of sufficient size to provide sustenance for a settler, and they are all of small agricultural value without irrigation.

In township 17, range 27, east of the river, the hills rise steeply from points one-half to three-quarters of a mile from the river's edge, leaving small areas of bench land in sections 5 and 8, also about five acres in section 20, a considerable area adjoining but not included in lot 82 in sections 19 and 30, and a small area in section 31. These areas are all at an elevation suitable for fruit-growing, but require irrigation for successful cultivation. In the upper valley of Luluwissin creek there is considerable land in sections 22 and 23 suitable for hay-growing, but oats tried in this locality were not successful on account of the elevation, which is 3,500 feet above sea-level. A valley extends southward through section 15 containing an area of gently-sloping land fit for hay-growing. Having a southern exposure it is probable that this land would require irrigation in spite of its elevation, which is also in the neighbourhood of 3,500 feet above sea-level. In township 18, range 27, the only land of agricultural value found was in the southwest quarter of the township, and consisted of a small area adjoining lot 83 to the east in section 6, and about fifty acres some two miles up the creek valley in section 5. The remainder of the township is rough timbered hills.

In township 18, range 28, east of the Fraser, lie a number of small areas of dry sandy loam bench land suitable for fruit, if irrigated. Sections 1, 12, 13, 14, 22 and 23 contain small areas of this nature, none of which is sufficient alone for one holding and all of which need abundant irrigation. A fine area of bench land is found in section 26 at an elevation suitable for mixed farming, though a trifle too high for fruit-growing. These bench lands could be irrigated from Cinquefoil creek and a dam at its south end would turn Cinquefoil lake into an ample reservoir for the irrigation waters.

The hills to the east of the main valley of the Fraser are rough throughout and the timber on them is of little value. They are covered mostly with a small scrub variety of pine and fir, the only areas of timber having any value being in the easttern part of township 17, range 27, and in the northern part of township 18, range 28, where a very fair class of bull pine and fir was found. On August 12, I crossed Fraser river by ferry and established the main camp in section 7, township 17, range 27, from which point I proceeded to examine the lands to the west of the river from the boundary of the railway belt southward. On the 21st, I moved camp southward to section 22, township 15, range 27, and continued examination of lands to the west of the river as far south as township 14.

The lands west of the Fraser, bordering as they do on the mountains of the coast range, presented the roughest area encountered up to that time in the season's work. All the land of agricultural value found, lies within a mile of the river, the high mountains rising in some instances right from the water's edge. Fractional township 18, range 28, contains about 200 acres of excellent fruit land in sections 11, 14 and 15. This land borders on the Fraser and has a creek flowing through it which should provide abundance of water for irrigation purposes. Several old buildings are seen, and the land has every appearance of having been cultivated at one time. It is nearly all cleared and the loam soil, though slightly sandy, should prove very fertile under proper treatment. The remainder of the unsettled part of this township, west of the river, is steep rocky mountains covered mostly with timber, which is of small value on account of its inaccessible position.

Coming south into townships 17, in ranges 27 and 28, I found a number of small but fertile benches of excellent loam and sandy loam soil, generally suitable for fruit-growing, but in one or two instances more suitable for hay. These lands, with the exception of certain areas which lie as far as two miles westward, in the valleys of Intlpam and Siwhe creeks, are all situated within one mile of the river. The most southerly of these lands in this township is situated immediately west of the Fraser, partly in township 17 and partly in township 16. An area of about twenty acres of this land, although still undisposed of, is cultivated and, at the time of examination, was producing an excellent crop of beans.

Two factors may enter into the reason why these excellent lands, with abundance of water for irrigation purposes nearby, should not have been settled before now. Firstly, they are only accessible by pack trail from Lillooet, or by wagon road and ferry from Lytton. As there is only one ferry between Lytton and Lillooet, and it is privately owned, this feature places the lands in an undesirable position. Secondly, a number of these benches are at present occupied and cultivated by Indians, as for instance the bench at the south boundary of township 17, and the process of ejection is not attractive to the ordinary settler, possession being nine points of the law in the eyes of the red men.

Continuing southward through township 16, the country to the west of the river is essentially mountainous and, with the exception of those lands already laid out in Indian reserves, only two areas of agricultural land were discovered. One, already mentioned, at the north boundary of the township consists of about fifteen acres of bottom land at an elevation of 1050 feet above sea-level, in the southwest quarter of section 20. This last is at present under cultivation and is occupied by Indians.

The lands in township 15, range 27, west of the Fraser, follow the general character of lands in that locality. A strip of rolling bench land from one-half to one mile in width is found along the river between the water's edge and the mountains proper. West of this strip the mountains rise in rock formation towards summits of, in some instances, 8,000 and 9,000 feet above sea-level. Sections 28 and 33 hold a large area of workable bench land of sandy loam soil suitable for fruit-growing. About one hundred and sixty acres of workable land is contained in this area, fifty acres of which is cultivated and is producing hay. This land is evidently occupied by Indians.

Agricultural land is also found in considerable areas in the southern parts of sections 22 and 23, and the northern parts of sections 14 and 15. Some of this also is under cultivation in hay and is occupied by settlers. Other agricultural areas, about seventy-five acres in extent, were found around the northeast corner of section 2; some of these are also under cultivation in hay. The southwest quarter of section 1 contains a number of small areas of bench and bottom land of from two to five acres each, which are mostly under cultivation in hay or fruit and are evidently utilized by Indians. The land undisposed of in this township is nearly all timbered, but no areas of timber particularly valuable for lumbering purposes were noted. Bull pine and fir are scattered throughout, and show the greatest value in the south part of section 1, and in certain areas on the south side of Stein creek in the centre and west part of the township. Practically no grazing lands lie in this township.

On August 28, I returned to my old camp in township 17, range 27, west of the Fraser, to complete the examination of certain lands overlooked before on the assumption that they had been disposed of as Indian reserves. It was my intention here to move into the country surrounding the upper waters of Stein creek to make an examination of the lands there, upon which considerable comment, favourable and otherwise, was heard in the neighbourhood of Lytton. To this end I moved my outfit to Fish lake in the west part of township 17, range 28, with the intention of reaching the upper waters of Stein creek by way of a trail used by Mr. A. W. Johnson, D.L.S., about four years previously, in taking in survey supplies. At this point a continued heavy snowfall was encountered, completely obliterating the old trail which was, at best, difficult to follow. Snow continued to fall and the Indian who was to guide us over the passes failed to put in an appearance, so I decided to waste no more time in this attempt and moved my camp back to the Fraser, crossed to the east side by ferry and moved to a point in section 8, township 15, range 26, where, on September 9, I continued examination of lands eastward along the main valley, and to the south of, Thompson river.

Township 15, range 26, south of the river is a very rough area, consisting of steep mountain slopes rising from near the water's edge southward toward the summit of the Lytton mountains. A few small areas of stony bench land remain undisposed of in this locality, but they are of small importance on account of the difficulties in the way of irrigation. The chief characteristic of much of this area is its steepness and inaccessibility. It is timbered with a fair quality of pine and fir. The lands in the east part of township 15, range 26, north of the Thompson are chiefly rock hills, sparsely timbered with small and medium-sized pine.

On September 12, I moved camp to a point on Nicoamen river in township 15, range 25, and continued the examination of lands in the main valley of the Thompson, and eastward through that township. No agricultural land was found in this vicinity west of the river, the surface being steep rocky side-hill, sparsely timbered with small pine and fir. Areas south of Thompson and Nicoamen rivers show no agricultural land of importance, the whole being timbered hilly country, with some scattered areas of good pine and fir. Sections 16, 20, 21 and 22 contain areas of bench land aggregating about one hundred and twenty acres. The areas in sections 16, 20 and 21, to the extent of twenty acres, are dry sandy loam land, very suitable for fruit-growing, but they would need abundant irrigation. The lands in section 22, to the extent of about one hundred acres, lie at an elevation of 2,800 feet and upwards, and have possibilities of fertility under dry culture. They are gently rolling, of sandy loam soil, slightly stony in places, and are timbered throughout with a fair quality of pine and fir. This area is at too great an elevation to be irrigated from Nicoamen river; the lands in sections 16, 20 and 21, however, could be irrigated from it, but at considerable expense.

Considerable land in the northeastern part of the township on the Nicoamen plateau is gently rolling semi-open land with good sandy loam soil, but it is unlikely

Photo by E. Deville, D.T.S.

Looking down the Athabaska, Jasper Park. Maligne Mountains in the distance.

Photo by E. Deville, D.T.S.

Lake Patricia, Jasper Park.

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that these areas have any great agricultural value on account of their inaccessibility, though their altitude, which reaches 3,500 feet above sea-level in places, may not be too great for dry culture. No areas were found under dry culture at any altitude in this locality, so no report as to its possibilities could be obtained. The remainder of the land in township 15, range 25, is rough and valueless except for grazing purposes and for scattered areas of timber of merchantable size.

On September 19, I moved camp to a point near the north boundary of township 15, range 24, about three-quarters of a mile west of Nicola river, and proceeded with the examination of the lands adjacent thereto. On September 24, I moved camp to a point in section 4, township 15, range 23, and on the 28th to a point west of Spius creek in section 35, township 13, range 23, continuing examination of lands southward up the creek valley.

A few small benches of sandy loam soil were noted adjoining Nicola river in township 16, range 24, of an aggregate area not exceeding seventy-five acres. Other small areas about one mile west of the river in the southern part of the township were noted, as well as an area of about twenty acres in extent along the south boundary of section 5, which has been fenced and cultivated. These are the only areas of agricultural land found in townships 15 and 16, west of Nicola river in range 24. Township 16, range 24, contains a large area of good grazing land west of the river, but little timber of value is seen except in the southwestern part. Continuing southward along the valley of the Nicola, the lands to the west are chiefly rough timbered hills as far south as the south boundary of township 14. In township 15, range 23, there is an aggregate area of about seventy-five acres of agricultural land undisposed of, lying in sections 8, 9 and 16, about forty acres of which is at an elevation suitable for dry culture, and the remainder of which would need irrigation. Some good areas of timber are found in townships 14 and 15, particularly along a creek valley in the west part of township 14, where a quantity of excellent bull pine and fir up to thirty inches in diameter is found. It is, however, in an almost inaccessible locality, and has small monetary value on that account.

The agricultural lands of township 13, range 23, were found to be fairly well settled, and little land of this nature remains unoccupied. Areas of good sandy loam soil suitable for cultivation, and totalling about one hundred and twenty acres, were found in sections 23, 27, 33, 34 and 36, but only one of these patches seems to be of sufficient area for a single holding. This area, containing about fifty acres of jack-pine flat in section 33, is at an elevation of 3,100 feet above sea-level, and should be suitable for dry culture. The chief asset of the lands undisposed of in township 13, range 23, is the timber, much of which is excellent pine and fir up to thirty inches in diameter.

On October 7, I moved camp to a point in township 12, range 23, near the junction of Spius and Prospect creeks, and on the 15th to a point on Spius creek in the north part of township 11, range 23, and proceeded with the examination of lands in those townships.

In township 12, range 23, a considerable area of rolling and gently-sloping land was discovered which is attracting the attention of settlers. This land is chiefly in the neighbourhood of the junction of Prospect and Spius creek valleys. It lies at elevations from 3,000 to 3,500 feet above sea-level and has a fertile loam or sandy loam soil. These features suggest that the land would be suitable for dry culture, and the large timber and luxuriant undergrowth suggest great fertility. Four squatters' notices were discovered posted on this land and two more westward up the valley of Prospect creek. It is claimed that the temperatures of this area are not more severe than those in the neighbourhood of Merritt, B.C., the altitude of which is over 1,000 feet lower. I was unable, however, to find any authentic record of temperature to bear out this claim.

Another area of excellent bench land was found at the south boundary of the township and extending southward into township 11, as well as a number of small benches west of Spius creek in township 12. The soil in these areas is sandy loam and at elevations of 3,000 feet and upwards is covered with a luxuriant growth of grasses and shrubs. The main area, however, is about one hundred and fifty acres in extent and lies in the east part of section 4, township 12, range 23. Its elevation averages 2,750 feet above sea-level and it is quite free from undergrowth, being covered with open bull pine timber averaging sixteen inches in diameter. Irrigation of this area could be accomplished from Spius creek. Much good pine and fir was noted in township 12, but the timber in township 11 is small and much of the south part of the township has been burned over. Only a flying examination was made of Prospect valley west of range 23, it being found to contain only steep side-hill lands, except near the head-waters where the elevation was found to be in the neighbourhood of 4,000 feet above sea-level.

The country in the central and south part of township 11, range 23, proving rough and useless, I discontinued work in that locality, and on October 23 moved my party eastward into the valley of Coldwater river and thence southward to a camp in township 9, range 23, where I continued work in the Coldwater valley and in the neighbourhood of Murray lake.

A few acres of good land suitable for hay-growing were found at the north end of Murray lake in township 10, range 23. About fifteen acres of this is slashed and cleared, and some of it planted in hay. The elevation around Murray lake is too great for anything but hay, being 3,670 feet above sea-level. No other agricultural land was found in township 10, range 23. The township is very mountainous throughout, and presents little value of any kind. A detailed examination was not made.

Township 9, range 23, is traversed from north to south through its eastern part by the valley of Coldwater river, which is a narrow valley of bottom land flanked by steep rolling hills. Extending almost to the south boundary of the township this strip of land varies in width from ten to thirty chains, and in one place to nearly one mile, and shows agricultural value throughout. Its soil is composed chiefly of a reddish loam, the appearance of which suggests the presence of a small amount of clay. Certain areas show a gravelly subsoil, but these are not large in extent. Its elevation ranges from 3,180 feet above sea-level, in section 36, to 3,400 feet and upwards in section 2. Hay-growing should be successful throughout, and even the hardier vegetables should do well in the northern part of the valley. There is very little grazing. The value of the timber is small in the northern part of the township, there being a great deal of scrub growth west of the river. There is, however, some spruce, fir and pine fit for railway ties. Much of the land in the centre and south part of the township has been burned over and all the timber destroyed. Settlers are already moving into this valley, and with the completion of the Kettle Valley railway the development of the valley should progress favourably.

On November 2 a heavy snowfall was encountered. I accordingly discontinued work in range 23, and on the 4th moved my party towards Merritt, B.C., where I arrived the following day. On the 6th I sent my pack train, loaded light, overland to Lytton, sent my camp equipage by express and took my party there by train. At this point, not being able to obtain a wagon and team to move my outfit, I was obliged to await the arrival of my pack train, which reached Lytton on the evening of November 7. The next day I moved south to a camp in section 36, township 13, range 27, and continued the examination of lands in the main valley of the Fraser.

Practically no agricultural land of importance was found in townships 13 and 14, west of the river. Bordering, as these lands do, on the mountains of the coast range, they are composed almost entirely of steep rocky slopes rising from the water's edge. There are, however, a couple of small benches adjoining the river and immediately south of Skway-ay-nope Indian reserve No. 26. These benches, having an

aggregate area of less than twenty acres, are suitable for fruit-growing; a small portion of the area is cultivated and utilized by Indians. The hills are all timbered with small and medium-sized fir and pine.

East of the river in these townships much the same conditions exist, although the slopes are less sharp. For about three-quarters of a mile east of the river the slope is fairly gradual, but at this point the base of the mountains proper is reached. In the southern part of township 13 the mountains rise to eastward, right from the water's edge. An aggregate area of 50 acres agricultural land was found undisposed of in townships 13 and 14 east of the river. This is scattered in various small areas throughout sections 24 and 25 of townships 13, and sections 1, 23, and 25 of township 14. Most of them are occupied, and some cultivated, by Indians. The lands east of the river are all more or less timbered, but on account of the rocky formation the timber is small and scrubby.

On November 12, I moved camp southward to a point in township 12, range 26, east of the Fraser and near the northeast corner of section 19, and continued the examination of lands in this township and in that to the south.

The Fraser valley through these townships follows its general character, although the lands in township 12 have a somewhat gentler slope near the river. In township 12 the lands rise to the east and west from the water of the river, leaving small areas of bench land from one to one and a half miles from the river, from which points the mountains rise steeply through rocky formation. The bench lands in township 12, range 26, to the east of the river, are chiefly small areas of loam and sandy loam soil, at present occupied and in some instances cultivated by Indians, notably in sections 3, 4, 9, 10, 16 and 20. An aggregate area of over three hundred acres in these six sections is agricultural land, all of which is less than 1,600 feet above sea-level. It is claimed by the occupants of these lands that local conditions of temperature render them unfit for fruit-growing in spite of the low altitude. This condition is not consistent with conditions to the west of the river, where a flourishing orchard was found at an elevation only slightly less than that of the greater part of these lands. In my opinion these lands could be utilized for almost any kind of agricultural development. A long narrow bench runs parallel to the river through sections 29 and 31 and contains about seventy-five acres of land more adapted to fruit-growing than to other agriculture. Its soil is a deep sandy loam, with a large amount of surface stones.

West of the Fraser, in township 12, range 26, the lands suitable for agricultural development are fairly well taken up. There remains about one hundred acres of good bench land in section 5, about five acres of which is cleared and the remainder covered with a rather dense growth of small fir, birch and alder. Small benches, to the extent of about forty acres were also noted in sections 8 and 17; all of these are at an elevation suitable for fruit-growing. The timber in this township is of small value except in the area included in timber berth No. 428 and in sections 3 and 9, east of the river, where some good tie timber was seen.

In township 11, range 26, east of the river, only a few small benches adjoining the river were found; the most notable of these lie parallel to the river through section 14, adjoining Boston Bar Indian reserve No. 4. Old buildings there showed past occupation, and in the land south of the reserve some recent improvements have been made. This land shows good deep sandy loam soil and should produce a very good fruit crop.

West of the river a number of benches, having an aggregate area of about two hundred acres, were noted in sections 11, 14, 15, 32 and 33. This land is generally of sandy loam soil with some areas slightly gravelly and stony and all at an elevation suitable for fruit-growing. Portions of this area near the river are open, but most of the area is timbered with a dense growth of young fir, birch and alder. The remainder of the township is timbered throughout, but no timber of merchantable value was noted, it being of a small and scrub variety on account of the rock formation.

At this point, on account of the difficulty in obtaining feed for the horses, and the small amount of land still to be examined in order to close on lands examined by Mr. G. A. Bennett, D.L.S., in 1910, I decided to disband my party and complete the work without their assistance. Having therefore completed as much as could be satisfactorily done from my camp in township 12, range 26, I moved into Lytton on November 22 and, when I had disposed of my outfit, disbanded my party. I then went to North Bend by train and made an examination of the lands east of the Fraser in townships 9 and 10, range 26, and part of the township west of the river.

After a preliminary examination of townships 9 and 10 east of the river, I was convinced that a detailed examination was unnecessary. The valley of the Fraser in these townships presents a much rougher area than that met with heretofore in this season's work. Throughout almost the entire length of the valley in these townships the steep rocky mountainous slopes to the east of the river rise from the water's edge. The only agricultural land noticed has already been disposed of. The lands are timbered throughout, but the timber is similar to the general class on these mountains, being small and scrubby.

Throughout the work of this season many unsurveyed lands were examined and it was necessary to tie these lands to the Dominion system. This was done almost entirely by stadia traverse, which method was found most satisfactory, both as regards speed of operation and accuracy. The elevations determined in the work are all given in feet above sea-level. These were computed from the readings of aneroid barometers which were compared each day with a large stationary aneroid kept in camp. Readings were taken on the camp aneroid every two hours and, by interpolation, practically simultaneous readings were obtained, one aneroid, the stationary, being read at a point whose elevation was known, and another at the point whose elevation was desired, or vice versa. In this way, by a system of back-sights and fore-sights, actual elevations above sea-level were carried throughout the work, it being the rule to first obtain the elevation of the stationary aneroid at camp and compute the other elevations from this known point. Besides the elevations of various points along the main line of the Canadian Pacific railway, which were furnished me with my instructions, the elevations of certain bench-marks determined in the survey of the Canadian Northern Pacific railway in the Fraser valley, of the Canadian Pacific railway in the Nicola valley, and of the Kettle Valley railway in the Coldwater valley in range 23, were used as bases from which to compute elevations of other points.

On November 27, having completed work for the season I returned to Lytton and when I had completed my arrangements there, went to Kamloops, where I spent parts of two days in the Dominion Lands office checking over areas disposed of and not shown on the district plans. I left Kamloops on November 29 for Orillia, Ont., where I arrived on December 4.

I have the honour to be, Sir,
Your obedient servant,

A. V. CHASE, D.L.S.

APPENDIX No. 22.

REPORT OF G. C. COWPER, D.L.S.

RESURVEYS IN SOUTHERN ALBERTA.

WELLAND, ONT., February 7, 1913.

E. DEVILLE, ESQ., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR, I have the honour to submit the following report on miscellaneous surveys and resurveys carried on in southern Alberta last season.

I left Welland on May 3, and reached Medicine Hat with my horses and outfit on the 14th of that month. After spending a few days in Medicine Hat in organizing my party, getting the horses shod and wagons repaired, I left on the 21st for township 19, range 4, west of the fourth meridian, following the main trail from Medicine Hat to the forks of Red Deer river.

For the first sixteen miles from Medicine Hat the country along the trail is very well settled, and the farmers, who go in mostly for mixed farming, appear to be quite prosperous. Farther north the land is more or less hilly and sandy, and has not as yet been taken up. After leaving the settled country, water along the trail is very scarce. My work here was to make a survey of townships 10, ranges 3 and 4, west of the fourth meridian. This was completed on July 8.

My next work was to make a retracement survey of townships 17 and 18, range 3, and a resurvey of township 17, range 4. When these townships were originally subdivided, river lots were laid out along South Saskatchewan river. These lots were afterwards done away with, and the monuments marking them destroyed, but the section lines through the river lots were not run. My work in townships 17 and 18, range 3, was to retrace the lines already run, and to survey the lines which had not previously been run.

To get from township 19, range 3, to township 17, range 3, I found it necessary to move my party eighty miles around by Medicine Hat, as I was unable to find a suitable place to ford the river. The trail from Medicine Hat to township 17, range 3, is the main trail north on the east side of the river. The country is better settled on this side than on the west side, and the land is pretty well taken up as far as township 17.

I commenced the survey of townships 17 and 18, range 3, on July 15, and completed it on August 20. From there we moved into township 17, range 4, the survey of which occupied the party until September 10. This completed my surveys in this district.

These townships, with the exception of township 19, range 3, are admirably suited for ranching, which is the main occupation of the settlers. Townships 17 and 19, range 4, are practically all under lease for ranching purposes. Township 19, range 3, with the exception of a few sections on the south side of the river, is practically all sand hills, and willow and rose-bush scrub, with a few scattered poplar trees.

Townships 17 and 18, range 3, have been under leases for ranching, but as the leases are expiring the homesteaders are taking up the land. While I was camped in township 17, range 3, six quarter-sections were filed on in this township. The soil being a mixed sandy and clay loam is well suited for farming, but the rainfall is light.

It is commonly believed, however, that as the land becomes broken the rain increases, and if this be the case the homesteaders here should meet with success, especially if they go in for mixed farming. The country is all prairie, and, with the exception of a little scrub in the coulées, and a few trees along the river, there is no wood.

The Saskatchewan, which cuts all the townships we worked in with the exception of township 19, range 4, has high cut banks from four to five hundred feet in depth, with deep coulées running back from the river. The current varies from about four to eight miles an hour, and in some of the rapids exceeds even this. During the past season a number of settlers taking up land at the forks of Red Deer and Saskatchewan rivers used the river to float down their lumber and supplies from Medicine Hat.

A large number of rattlesnakes frequent the shores of the river, and during the time we were working there my party killed over three hundred of them.

My next work was to survey some lines in townships 21 and 22, range 10, west of the fourth meridian, which had not been previously run owing to the fact that river lots had been laid out along Red Deer river. I took the party back to Medicine Hat and followed the Canadian Pacific railway as far as Carlstadt, from which place we turned north, reaching township 21, range 10, on September 17.

Owing to a number of homesteaders being absent I could not get them to agree to my erecting monuments which would affect their boundaries, and consequently was unable to erect a number of monuments marking my survey. I therefore left blank petitions for resurveys in both townships.

These townships are fairly well settled, some of the settlers having lived there four or five years. The crops on the whole were very good, flax, running eighteen and twenty bushels to the acre, while potatoes and other vegetables did very well. On the north side of the river the settlers have great difficulty in getting water, and the majority of them have to haul all the water they use from the river. The Government drilled a well over 300 feet in depth but the water found was not very good.

After completing these surveys, I returned to Medicine Hat, disbanded my party on October 4, and put my horses out for winter. One of my assistants went with Mr. Deans on inspection work in Manitoba, and with the other I started out to do miscellaneous surveys.

My first work was to investigate a lake in section 3, township 10, range 12, west of the fourth meridian. I found that it had dried up and that the whole section was suitable for farming purposes.

My next work was the survey of an island in Beaver lake in township 51, range 17, which I completed on October 22. I then went to Heath to investigate Barnes lake in section 1, township 44, range 5. I found it to be incorrectly shown on the township plan, but owing to it being surrounded with thick brush and scrub, and being unable to hire any axemen, I left the traverse until the lake froze over. I then returned to Edmonton and retraced that portion of section 24, township 53, range 27 which was formerly part of the Michel Calahoo Indian reserve. I made this survey on October 31 and next day drove to section 32, township 51, range 26, and made a survey of a lake in this section on November 2.

I then investigated Sullivan lake in section 2, township 36, range 14, and finding that there was some dry land in the section I made the necessary surveys on November 6.

I next went to township 40, range 5, and surveyed a lake in section 18 on November 9. Returning to Heath I found Barnes lake frozen over and traversed it on November 12, leaving for Edmonton the next day.

Here I found instructions to complete some traverses in township 60, range 1, and townships 64, ranges 4, 10 and 12, west of the fourth meridian.

After securing a small camp outfit, we left Edmonton on November 18 for Lloydminster, and from there we drove to Onion lake, where we secured a team and half-breed driver. We followed the main Cold lake trail as far as Angling lake, where

we turned off to do the work in township 60, range 1. From there we had to pack for six miles to get to the work, which we completed on November 27. We then returned to Angling lake and reached the south end of Cold lake on November 29. From this place we found a trail to township 64, range 4, and finished the survey there on December 1.

To get from township 64, range 4, to township 64, range 10, I found it necessary to return to Cold Lake mission and follow the St. Paul trail as far as Rife, from which place we turned north. There is, no doubt, a direct trail fom Cold lake to lac La Biche, but owing to the lateness of the season and the small amount of feed for the horses which we were able to carry, it was imperative that we keep as much as possible to settled districts. We reached township 64, range 10, on December 7, made the required survey that day, and the survey in township 64, range 12, on December 9. We then started back for Edmonton and reached St. Paul de Metis, a busy town of about three hundred people, on December 12. I sent the team and teamster back to Onion lake and, with my assistant, took the stage to Vegreville, arriving at Edmonton on December 14.

The country north of Saskatchewan river is very well settled, and I was surprised at the prosperity of the farmers, some of whom, although over 100 miles from the railroad, have good buildings and all the conveniences of a farmhouse in Ontario. With the completion of the railroad from Battleford to Edmonton this country will make rapid progress.

I closed operations for the season at Edmonton and reached Welland on December 23.

I have the honour to be, Sir,
Your obedient servant,

G. C. COWPER, D.L.S.

APPENDIX No. 23.

ABSTRACT OF THE REPORT OF W. J. DEANS, D.L.S.

INSPECTION AND MISCELLANEOUS SURVEYS IN MANITOBA AND SASKATCHEWAN.

I left my home on May 28 for Prince Albert, where I intended to organize my party. Owing to the lateness of the season and the scarcity of labour it was June 5 before I left there for Shellbrook, where I procured my horses and outfit. On June 9, I started for contract No. 11 of 1911 in the vicinity of Boutin, where my inspection work was to begin.

The country between Shellbrook and Boutin is well adapted for agriculture and is being rapidly taken up by a good class of settlers. There are, however, many homesteads in this district which are still available.

On June 13, after a pleasant trip over a good trail, I arrived in township 54, range 8, west of the third meridian, which forms part of contract No. 11 of 1911.

The land comprising this township and townships 53 and 55 is generally adapted for mixed farming purposes. The soil is good and there is an abundance of hay in the marshes, and good water in the numerous lakes, while suitable timber for building purposes may be obtained in many places. The Big River branch of the Canadian Northern railway is located a short distance east, which makes access to the markets easy and certain at all seasons of the year.

My next work was to correct the road allowance between townships 50 and 51, range 12, west of the third meridian. On June 19 I started for this place over the Green Lake trail, which I found in good condition. I travelled on this trail about thirty miles, then forded Big river and passed down the west side of Witchekan lake. There is an extensive area of good agricultural land west of the lake, mostly open prairie with light poplar scrub in places. I did not see any settlers, although this land is open for homesteading. About half way down the lake on the west side we came across numerous wicker and rustic structures which had been erected recently by the Indians.

On June 21, I arrived in township 51, range 12 and next day started to resurvey both sides of the road allowance between townships 50 and 51, which had been left too wide when the townships were subdivided. While on this work we had some heavy gales which blew down trees in all directions, and also our tents. These winds were followed by cold rains which made our progress slow, so that work which could have been completed in a week under ordinary weather conditions required twice that time.

I also made some other corrections in this vicinity, and on July 14 started for Shellbrook. On my way I branched off at Mistowasis to investigate the marking of the post at the northeast corner of section 12, township 49, range 9, west of the third meridian. I found that this post had been correctly marked.

There is quite an extensive unsettled country west of Mistowasis which is open for homesteading. The country is somewhat broken with ridges and sloughs and covered more or less with small poplar and willow, but the soil is a good black loam. Pea-vine and grass grow in great luxuriance throughout the district and the sloughs are full of good water, which makes this a splendid country for mixed farming and cattle raising.

On July 22, I arrived at Shellbrook and on the 24th shipped my outfit by the Canadian Northern railway to Tisdale, at which place it arrived on July 31.

On August 1, I started for Arborfield from which place I sent in a portion of my party with pack-horses to inspect the northerly part of contract No. 7 of 1911. The country between Arborfield and Tisdale is fairly well settled, but there are still quite a number of homesteads open for entry. The soil generally is a black loam with clay or sand subsoil and produces crops of wheat, barley and oats which could not be excelled anywhere. There is an abundance of wood suitable for fuel, and plenty of timber for building purposes. The trails and roads are good. The settlers have good buildings, and schools and churches are within easy reach of all. The water in the numerous streams is good, and grass and wild pea-vine grow luxuriantly. Horses, cattle, sheep and hogs all thrive in this district. Wild fruit, such as raspberries, grow in great profusion. We passed a great many berry pickers on the road all laden with large quantities of berries. A settler coming to this part of Saskatchewan who possesses ordinary intelligence and industry would have a competence in a few years, for nature has certainly distributed her bounties with a generous hand. There are a great many homesteads available east of Arborfield and a number of settlers were engaged cutting a trail into township 48, range 10, west of the second meridian, so that now these new lands are easily accessible.

On August 8 I started for Tisdale, arriving there on the following day. From there I shipped my outfit to Mistatim in order to continue my inspection of contract No. 7 of 1911. Owing to the great rainfall in July and August, the country around Mistatim was very wet, and I found it a most difficult undertaking to get into contract No. 7, even with pack horses. I finally cut a trail to the northeast corner of township 45, range 10, from which point I conducted most of my inspection.

The surface of the land in the southerly part of contract No. 7, *i.e.*, in township 46 and the northerly part of townships 45, ranges 9 and 10, and around Mistatim is gently rolling and covered with a thick growth of poplar and small birch, with patches of spruce suitable for sawlogs. There are many sloughs, marshes and small lakes throughout the district. Grass and peavine grow very rank. This will be a good mixed farming country when cleared and drained. There is a saw-mill at Mistatim which runs during the summer months and employs a large number of men. This company was unable to obtain sufficient help last season, although they offered $2.50 per day for labourers. There are no settlers around Mistatim engaged in farming, although there are many homesteads which would be productive with little labour, and as all produce has to be brought in by train a settler engaged in farming would be sure of a good market for any produce.

On August 23, I shipped the outfit by Canadian Northern railway to Portage la Prairie, where it was decided to leave it temporarily while I proceeded with the inspection of contract No. 19 of 1909 in townships 7 and 8, ranges 16 and 17, east of the principal meridian. I accordingly left for Kenora, where I hired a gasolene launch and went up to Indian bay, the extreme westerly part of Shoal lake.

I arrived at this contract on August 31, and on September 2 started the inspection. The greater part of the contract consists of tamarack muskegs, willow swamps and rocky ridges covered with scrub jackpine. The heavy rains of July, August and September filled the muskegs to overflowing, so that the inspection of the contract was very difficult. In addition to the rain we had three days of snow and sleet near the end of September, all of which interfered with the progress of our work. I also surveyed timber berth No. 1903, which is situated in this contract.

On September 27, I started for Kenora with my outfit loaded on a gasolene launch and barge. The lake got so rough that we were in danger of being swamped, so we had to put into an island and unload the men and outfit. Having done this, I started with two men in the launch, and, after a stormy time, reached Kenora that night. The next day I sent out a launch and brought the outfit and party in.

My next work was around Brereton lake. Certain lands in this district were urgently required, and before they could be dealt with it was necessary to have a

survey made and confirmed. I also had to inspect contract No. 1 of 1911 and contract No. 24 of 1908 in this vicinity. The lands throughout these two contracts consist largely of tamarack muskegs, willow swamps and rocky ridges. In the westerly part of contract No. 24 there is some land suitable for farming purposes and in many places throughout both contracts there are small patches which would produce potatoes and garden vegetables in favourable seasons. Brereton lake is a fine sheet of good pure water about three and a half miles long by one and three-quarter miles wide, situated about seventy miles east of Winnipeg, and easily reached by the Grand Trunk Pacific railway. In many places around the lake the beach is sand, and there are seventeen islands of various sizes and shapes. Maskinonge are quite plentiful in the waters of the lake, and attain a great size. Moose and elk were seen nearly every day while we were engaged in this vicinity. This lake will no doubt become a favourite summer resort for the people of Winnipeg. The work around Brereton lake required a long time to complete on account of the wet nature of the country and the exceptionally wet season. In November we had sufficient frost to freeze the muskegs and marshes a little but not sufficient to carry the weight of a man. Breaking through the ice in a muskeg for the greater part of the day makes the carrying out of a survey very slow.

On December 14, I started with a portion of my party for Portage la Prairie, leaving my assistant and the remainder of the party to finish some work near Ophir. I shipped my outfit which had been previously left at Portage la Prairie to Glenella, where I was joined by my assistant and the remainder of my party. Here I procured two sleighs and some supplies and started north to inspect contract No. 5 of 1912, which lies northeast of lake Manitoba. This contract consisted of townships 21, ranges 11, 12 and 13, and townships 22, ranges 12 and 13, west of the principal meridian. These townships formerly formed a part of the Manitoba West Forest reserve. The land is gently-rolling with ridges running in a northwesterly direction, and contains many hay marshes. In many places there are quite large open tracts of prairie, but generally the land is covered with a thick growth of small poplar and willow; in the northerly part there are a number of fairly large bluffs of spruce from eight to twenty-four inches in diameter. The soil is good, and water of the best quality is easily obtained by digging a few feet. It is expected that a branch of the Canadian Northern railway will soon be extended through this district This would make the transportation of crops and produce to markets easy.

My next work was to examine a part of contract No. 11 of 1912, consisting of townships 23, ranges 12 and 13. The land in these two townships is much the same as in contract No. 5.

On January 5, 1913, I started with my outfit for contract No. 12 of 1912. I stayed for a day at Ste. Rose du Lac to procure supplies, and on January 7 started out for Toutes Aides, a post office on lake Manitoba. The travelling was slow on account of deep snow and very cold weather. There is an extensive country north of Ste. Rose du Lac between lake Manitoba and Dauphin lake, in which there are many homesteads available for settlers. The land is rolling and covered with willow and poplar scrub, with many patches of open prairie and hay marshes. In some places there are large bluffs of poplar suitable for building purposes. It is expected that a railway will soon run through this part. On January 10 we passed a number of fishermen engaged in their work. One of these men told me that he had taken over three hundred dollars' worth of fish in less than a month.

On January 11 I arrived on contract No. 12 and commenced my inspection on the 13th. Afterwards I inspected the remainder of contract No. 11 of 1912 and contract No. 10 of 1912.

These three contracts adjoin the northerly shore of lake Manitoba and stretch from Waterhen river to Portage bay. The whole district is generally level and covered with willow and small poplar, with patches of spruce, tamarack and jackpine,

which in places is large enough for sawlogs. There is an abundance of hay throughout the district, and the soil is good. Fish are plentiful in the lake and can be disposed of at a good price. Moose and elk are numerous. This district offers great inducements to the settler who wishes to engage in mixed farming or cattle raising.

On February 5, having stocked up with supplies and feed for the horses at Fairford, I started for contract No. 9 of 1912 and completed the inspection on the 12th. It was now necessary for me to cut about twelve miles of trail in order to inspect contract No. 8 of 1912, and as the weather was very stormy and the snow deep, I was somewhat delayed and did not arrive on this contract until February 19. I completed the inspection on the 22nd.

The country east of lake St. Martin for a distance of three or four miles is level, with many marshes and tamarack muskegs. Thence it ascends in flat ridges covered with jackpine. This part of the country was burnt over a few years ago, so that in many places there are large tracts of land on which the jackpine is from two to four feet in height. There are, however, many fine groves of jackpine from eight to twelve inches in diameter which escaped the fire. In township 29, rang 5, west of the principal meridian, there is some land suitable for mixed farming, but the chief asset of this district at present is the jackpine and tamarack, which would make cordwood and ties.

In order to reach contract No. 7 of 1912 it was necessary for me to cut twelve miles of trail, a good deal of it through windfall. This, with deep snow, impeded my progress so that it was not until February 27 that I reached this work. I travelled through this contract easterly a distance of twelve miles cutting trail the greater part of the distance. I finished the inspection of this contract on March 15, after which I inspected contract No. 6 of 1912.

The land in townships 28, range 3, 4 and 5, west of the principal meridian, is generally gently rolling and covered in the northerly part with a thick growth of poplar and spruce, which in some places is large enough for sawlogs. The southerly part of township 28, range 3, is very wet. There are a number of muskegs on both sides of Mantagao river, a small stream about fifty links wide, which flows northerly into lake Winnipeg. There is some good farming land in township 28, range 4. If Mantagao river was opened up a little, much of the adjoining land would make splendid hay meadows, on which hundreds of cattle could be raised.

On March 13, I moved camp to section 33, township 27, range 3, and corrected the marking on the monument at the northeast corner of the section. I had intended to return to Moosehorn, but owing to the depth of the snow and the scarcity of horse feed I thought it advisable to come out to the nearest settlement, where I would have good trails and plenty of hay and oats for the horses. I therefore came out to Fisher River settlement and thence to Arborg, the terminus of the Arborg branch of the Canadian Pacific railway. From there I proceeded to Portage la Prairie, where I stored my outfit.

The season was not a good one for field work. In July, August and September the rainfall was excessive so that progress was very slow, and as all the muskegs and marshes were full of water, wading through them in October and November was cold work. December, January, February and March were, however, very good months for working; the weather although rough did not seem to be excessively cold or stormy. I paid my party off on March 19 and arrived in Brandon on the 22nd, having been nearly ten months in the field.

APPENDIX No. 24.

ABSTRACT OF THE REPORT OF S. L. EVANS, D.L.S.

MISCELLANEOUS SURVEYS IN SOUTHERN SASKATCHEWAN AND ALBERTA.

My first work for the season of 1912 was in the Maple creek district where I made retracement surveys of township 8, range 22, townships 6, ranges 24, 25 and 26, township 7, range 28; and part of township 6, range 27; all west of the third meridian.

These townships lie to the south of Cypress hills, a range having an altitude of about 3,000 feet above sea-level.

At present, ranching is the chief industry of the district and some large and successful ranches are located on Whitemud river which runs through some of these townships. A few scattered quarters have also been taken up by homesteaders. To the south of these townships there are large settlements and, according to reports, the settlers are making a success of farming.

The soil generally is of a gravelly nature and this, coupled with the dry climate in this district, would seem to indicate that dry farming operations would have to be practised by homesteaders wishing to make a success of farming. I am, however, of the opinion that the district is best adapted for ranching purposes. Cattle and horses thrive well the year round on the native short sweet grasses.

Cypress lake, which is about six miles long by two miles wide, and the head of Frenchman river, is located in township 6, range 26. I believe this lake has been considered by the Irrigation Department as being suitable for a large reservoir for irrigation to serve the country lying to the south and east of the lake. This district would no doubt be much improved for agricultural purposes were this irrigation scheme carried out.

Along the bank of Frenchman river, large outcrops of a white clay appear. This clay is said to be excellent for pottery purposes and awaits development along this line.

Outcrops of lignite coal were seen on the north branch of Battle creek in township 7, range 28. There is very little bush in any of these townships, and the coal is thus a great boon to the homesteaders.

A great many antelope roam in this district, as many as thirty in a drove being seen by my party.

The Weyburn-Lethbridge branch of the Canadian Pacific railway is being built through this district. This will no doubt add a further incentive to agriculture.

In July the work in Maple creek district was suspended for a time and we proceeded to township 13, range 14, west of the third meridian, where some retracement surveys were required. We drove across country, a distance of about one hundred miles, following good roads and trails for most of the way. This township is well settled, mostly by Germans, and mixed farming is being carried on quite successfully. It may be noted that the rainfall is heavier in the districts east of the Maple creek country.

Towards the end of September I shipped my outfit to High River settlement for the foot-hill work, and on September 28 started by wagon for the northeast corner of township 20, range 5, west of the fifth meridian. This was readily reached by road to Okotoks, thence by trail up the north branch of Sheep river.

After running the east boundary of township 20, range 5, I proceeded to the northeast corner of township 20, range 6. To establish a camp near our work here we had to pack our tents and outfit ourselves.

The country is very rough and broken and lies close in to the Rockies . The north-east corner of this township is at an elevation of nearly 7,000 feet.

The survey of the east boundary of township 19, range 5, and the subdivision in township 19, range 4, was carried on from camps located on the south branch of Sheep river.

Some good seams of coal outcrop on the banks of both forks of this river.

The country is too broken and rough and is at too high an elevation for agricultural purposes. For the most part the surface is covered with second-growth jack-pine and small spruce.

The streams are very swift and no doubt offer possibilities in the way of future power development.

We had a considerable fall of snow during November, and owing to scarcity of horse feed we left on November 20 for High River settlement, where the party was disbanded.

I then proceeded with my assistant to Macleod for the traverse of Oldman river in townships 9, ranges 25 and 26, west of the fourth meridian. This was completed on December 17, and on the following day I left for home.

APPENDIX No. 25.

ABSTRACT OF THE REPORT OF J. A. FLETCHER, D.L.S.

OBSERVATIONS FOR LATITUDE.

Before commencing the season's field work I went to Toronto, on April 23, 1912, to make a determination of the constants of dip circle, T.S. No. 62. I was required to observe for magnetic dip and total force wherever possible during the season, and it was necessary to determine the constants of the statical needle both before and after the season's work. These constants were determined with the required precision by April 30, and I left that evening for the West.

I arrived at Salmon Arm, B.C., on May 4, and I found the weather at that time of the year to be very delightful. Rain falls in this vicinity in sufficient quantity to obviate irrigation, while the extreme moisture of the coast is escaped. The settlers here seem quite prosperous, the chief industries being fruit, hay and vegetable growing and dairy farming. Fruit, such as apples, pears, plums, peaches, cherries and the small fruits all mature well. Considerable cloudy weather was met with here and the observation was delayed somewhat on that account, but by June 3 it was completed.

I proceeded next to township 61 on the second meridian. I went by way of Regina, Prince Albert and Hudson Bay Junction to Pas, where I arrived on June 11. The same evening I left for Cumberland on a steam tug and scow owned by Captain Ross, who makes freighting trips up and down Saskatchewan river all summer. In this instance he had been engaged by the Hudson's Bay company to tow four of their York boats across Namew lake on their way to Pelican narrows and Churchill river. I accompanied them up the lake as far as the point projecting from the western shore in township 60. From there I proceeded to the point of observation on the second meridian in township 61, using a twenty-foot freight canoe kindly loaned me by Mr. E. M. Joyal.

On arrival at the point of observation, a space was cleared of trees and rubbish and the foundation prepared for the telescope. Some trouble was experienced in getting a good set up as frost almost a foot thick was still in the ground. By digging three holes for the tripod through the frost and packing the holes with beach sand, a very stable foundation was secured. The temperature while here was the highest experienced all summer, the mean of the temperature while observing at night being 58°. Several jackfish and pickerel were caught here with a line.

This observation was completed by June 28, and the return to Pas was made by canoe all the way, travelling on the lake only in fair weather. We entered Tearing river at eleven o'clock, and arrived at the Saskatchewan by four. Tearing river is very swift in some places, and only in high water does the steamboat use this channel. We reached Pas on July 4.

I proceeded next to Prince Albert and hired a wagon, team and teamster to take my outfit to township 57, on the third meridian. The trail which, on account of the wet season, was in some places difficult to travel, passes through a heavy clay loam for about two miles after leaving Prince Albert, and then crosses country generally with light or sandy soil. In the sandy districts the rain improves the travelling as the sand, when wet, is firm. While going north, Red Deer river was in its normal condition, and the river was crossed with no damage to the outfit, the water coming only to the wagon box. North of this the trail becomes worse, being quite stony in places, while several short and rather soft muskegs were crossed, some of them requiring brushing.

Owing to the heavy rainfall of June and July, mud holes were numerous on the final third of the trip. We arrived at the third meridian in three and a half days from Prince Albert and a good observation spot was at once chosen. Much rainy weather was experienced here, but by July 27 sufficient observations had been taken and the return journey commenced. The recent rains had flooded Red Deer river to an unusual height, but it had abated somewhat on our arrival. It was necessary to swim the horses and raft the outfit across; this was accomplished without difficulty or damage to the outfit although the water was about nine feet deep. Rabbits, partridge and prairie-chickens appeared to be numerous in this district.

I next proceeded to the sixth meridian in Jasper park by way of Edmonton and the Grand Trunk Pacific railway. At that time fully-equipped passenger trains were running as far as Fitzhugh in the Yellowhead pass. I left the train at the Jasper park collieries, the post-office of this place being Pocahontas. This was not at first intended as a regular stop by the Grand Trunk Pacific railway, but owing to the development of the coal mines in the neighbourhood, the traffic seemed to warrant it. The company in charge is developing these mines to a considerable extent and is producing a fine quality of steam coal. The trail runs westward from the collieries about three and a half miles and there crosses Athabaska river by ferry, and proceeds westwards along the north side of the river. The sixth meridian crosses a large level flat, partially timbered, in township 48. I selected my observation station here owing to the level nature of the country and the apparently equal distance from the mountains to the north and south. The point of observation is about a mile from the ferry, and near the trail. The observation was completed by August 22 and the return trip to Edmonton made at once.

I proceeded next to Calgary to observe on the fifth meridian near triangulation station No. 1. This observation was completed on September 12.

On the receipt of a telegram requesting me to observe at the triangulation station on Sugarloaf mountain, I left for Enderby, from which place the station is reached most conveniently. The trail to Salmon Arm passes south of Sugarloaf mountain, but a branch trail east of the hill passes within half a mile of the summit, which is easily reached by pack horses from that side. Mr. M. P. Bridgland, D.L.S., loaned me his packer and ponies to place the Zenith telescope outfit on the hill. I observed for latitude on the summit in the immediate neighbourhood of the triangulation station. The crops near Enderby were very good last year, fruit, potatoes and market garden crops all being plentiful, and hay of good quality and quantity is grown on the level lands.

On completing the observation here, I returned to Toronto and after a redetermination of the dip circle constants was made, I left for Ottawa, where I arrived on October 25.

The following are the results of the observations on the initial meridian:—

The northeast corner of section 13, township 61, on the second meridian, as defined by its witness post, is 0.25 chains too far north.

The northeast corner of section 13, township 57, on the third meridian, is 0.31 chains too far south.

The northeast corner of section 13, township 48, on the sixth meridian, is 5.67 chains too far north.

Thirty observations for magnetic dip and total force and twenty-nine for magnetic declination were taken during the season.

APPENDIX No. 26.

ABSTRACT OF THE REPORT OF L. E. FONTAINE, D.L.S.

INSPECTION OF CONTRACT SURVEYS IN ALBERTA.

My field work for the season of 1911 was not finished until February 10, 1912, and from that date until the middle of March my time was occupied in preparing reports on the contracts inspected.

On March 21, I left Edmonton with one assistant and one chain-bearer to examine some corrections which had been made in contract No. 23 of 1909.

When returning from this inspection I passed close to certain townships in contract No. 20 of 1911, and although I knew that the work was not completed, I decided to traverse part of Saskatchewan river in township 39, range 9, west of the fifth meridian, as conditions were very favourable for doing the work.

I then returned to Edmonton on April 4 and after organizing my party proceeded with the inspection of contracts Nos. 25, 26 and 28 of 1911, in the vicinity of Edson, completing the work on July 12.

After reorganizing my transport outfit at Edmonton, I left on July 19 for the Peace River district to inspect contracts Nos. 1, 2, 3 and 4 of 1912 travelling via Athabaska Landing, Mirror Landing, Grouard, Peace River Crossing, Dunvegan and Grand Prairie. When this work was completed I returned to Edmonton on November 18, via Edson, and paid off my party.

On November 25, I left for township 42, range 28, west of the fourth meridian, to resurvey the north boundary of the township but owing to an accident to my transit I was unable to complete the work. I therefore closed operations and left for home, arriving there on December 12.

Photo by A. H. Hawkins, D.L.S.
Bench Mark on Twenty-third base line west of the Fifth Meridian.

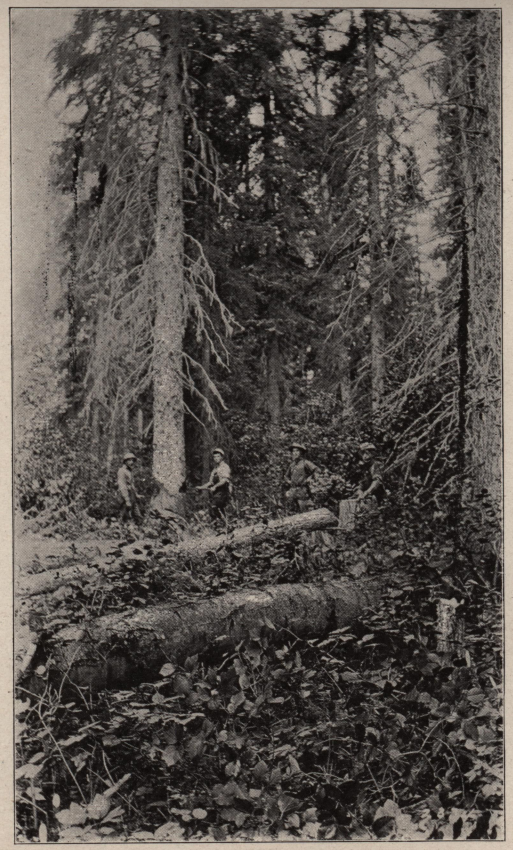

Photo by A. H. Hawkins, D.L.S.
Twenty-Third base line west of the Fifth Meridian in Range 18.

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APPENDIX No. 27.

ABSTRACT OF THE REPORT OF C. A. GRASSIE, D.L.S.

SUBDIVISION SURVEY IN JASPER PARK.

I have the honour to submit the following report of surveys performed in the Yellowhead pass district during the past season.

My work consisted of subdividing lands along the Canadian Northern railway now under construction, within the limits of Jasper park.

After a few days spent in organizing my party, I left Edmonton on June 10 via the Grand Trunk Pacific railway for Hinton, arriving there on the same day. We were delayed there two days waiting for the arrival of our supplies. On June 13 we proceeded by pack-train to township 49, range 27, west of the fifth meridian, camping on the right bank of Athabaska river near the mining village of Pocahontas.

From this camp we began subdividing in townships 49, ranges 27 and 28. The river traverses the lands that were to be subdivided. A considerable part of the lowland along the river was covered with water to such a depth that we were forced to abandon the work, leaving it to be completed later in the season when conditions would be better for surveying. We succeeded, however, in running two lines across the river.

The Jasper Park Collieries Company, Ltd., employ several hundred men in their coal mines in this district, and have been shipping coal for some time. The coal is bituminous. During the autumn and early winter of the past year they made extensive improvements to their plant, having built a large tipple and power-house. The Grand Trunk Pacific railway passes through township 49, range 27, following the right bank of the river.

On July 4 we moved camp to the west shore of Brulé lake, an expansion of Athabaska river. We transported the camp outfit and supplies across the river by boat, but had to send our horses around by way of Prairie creek on account of not being able to find a suitable place to swim them across the river.

In this district we subdivided those parts of townships 49 and 50, range 27, which are adjacent to Brulé lake. A good wagon road from Prairie creek follows the western shore of the lake to its head. The foot of Bullrush mountain is very close to the lake at the southern end, leaving only a narrow strip of valley between it and the lake shore, but this strip gradually widens towards the north.

The land is rolling and covered with small poplar and spruce. The soil consists of a sandy loam and clay mixed with sand. It would produce small fruits and vegetables, although light frosts occur in June. I chanced on a small garden in which all varieties of vegetables were grown with success. Wild strawberries were very plentiful.

Along the shore of the lake there is a strip of timber, chiefly spruce. Solomon and Moose creeks abound with trout for some distance up from their mouths.

The grade of the Canadian Northern railway, which follows closely the west shore of the lake, is nearly completed. Looking toward the east from the higher lands one gets an extended view of the lake and of the foot-hills, covered with forests of green spruce, while towards the west rises Bullrush mountain.

Brulé lake is being filled in with sediment brought down by the river, and consequently is very shallow. In autumn and winter when the water is low, the greater part of the bed of the lake is dry.

After completing the work in township 50, we continued our surveys in townships 49, ranges 27 and 28. Considerable difficulty was encountered in running the

subdivision lines across the Athabaska, as the river here is divided into several channels by islands which are covered with scrubby spruce and a thick undergrowth of brush, and contain swamps in their interior.

The land on the south side of the river is flat and low, being partially flooded during the time of high water, while that on the north side is rolling and hilly and covered with a scattered second growth of jackpine and spruce. A great part of these lands on the north side of the river and in the valley of Moose creek is leased for coal claims. The Jasper Park Collieries Company, Ltd., are developing their coal claims in township 49, range 27.

We also surveyed sections 24, 25 and 36 in township 49, range 1, west of the sixth meridian, and resurveyed the sixth meridian from the thirteenth base through township 49.

Bears and deer are plentiful in this district. The soil is clay on the high lands, while that of the low lands is clay and sand. Bordering the river, there is a narrow strip of timber consisting chiefly of spruce varying from four to eighteen inches in diameter.

On August 30, we began the subdivision of lands along the western shore of Jasper lake, and in townships 47 and 48, range 1, west of the sixth meridian. Jasper lake is also an expansion of Athabaska river, and, like Brulé lake, it is being filled in with sediment brought down by the swift waters of the river. During the time of low water, much of its bed is uncovered. Its banks on the west are high and steep, while on the east they are low. Immediately to the east, and separated from it by only a narrow strip of land, lies Talbot lake.

The country is rolling and hilly, and most of that part of township 48 which we surveyed is brulé, many fire-killed trees still standing. In some places windfall lies thickly on the ground. Rocky foot-hills rise from the shore at the head of Jasper lake, but farther south the valley widens again and the country is covered with small spruce and poplar. Part of section 5 township 47 is swampy and, in the western part, timber was seen up to three feet in diameter. Stony river flows through the northern part of township 48. It is a turbulent and swift-flowing river, whose waters flow through a deep and narrow channel until they near the sixth meridian where they spread out over a wide bed with low banks.

From this work we proceeded to Fitzhugh, a divisional point on the Grand Trunk Pacific railway, and situated on the left bank of the Athabaska. Here we surveyed the east and south boundaries of section 9, township 45, range 1, west of the sixth meridian. Miette river flows through this section. That part south of the Miette is brulé sparsely covered with small poplar, and that north of the river by jackpine. Along the banks there is spruce and fir, up to two feet in diameter. The Athabaska flows through the southeastern part of the section. The land here slopes sharply towards the river. The soil is a sandy loam with a gravel and stony subsoil.

Our next work was the survey of those sections in townships 45, ranges 2, 3 and 4, through which the Canadian Northern railway is being constructed. The land surveyed lies in the Miette valley, on the south side of the river. The valley is narrow, the mountains on the south rising almost immediately from the edge of the river. The greater part of these lands, therefore, is on a mountain slope and is exceedingly rough and rocky. In range 2 they are thickly wooded with small spruce and jackpine. In ranges 3 and 4 there is spruce and balsam timber varying from four to eighteen inches in diameter. The north side of the valley is mostly brulé, with scattered jackpine and spruce. A wagon road from Fitzhugh follows the river closely.

The summit of the Rocky mountains was traversed through sections 13 and 24, range 4, west of the sixth meridian. In sections 13 the summit is very much broken and was difficult to follow.

After having completed the survey of subdivision lines in this district we traversed Miette river from the east boundary of section 7, range 2, to its mouth, and

the Athabaska through townships 45 and 46, range 1, west of the sixth meridian; also of the Rocky and Stony rivers through subdivided land. Most of the traversing had to be done on the banks of the rivers, as very little ice had yet formed.

We completed the traverse of Stony river early in December, but were unable to ford it on account of its flooded condition, due to a blockade of ice. We were therefore unable to finish the surveys in township 49, range 27, west of the fifth meridian.

We accordingly ceased operations and took the train at Pocahontas for Edmonton. Arriving there on December 11, I disbanded my party, and having stored my outfit I left for Medicine Hat on December 17.

APPENDIX No. 28.

ABSTRACT OF THE REPORT OF A. H. HAWKINS, D.L.S

SURVEY OF THE TWENTY-THIRD BASE LINE WEST OF THE FIFTH MERIDIAN.

My work during the season of 1912 consisted of the survey of the twenty-third base line, from the fifth to the sixth meridian.

By arrangements made in 1911, hay was put up for use on this line, at Quitting lake in range 3 and also at Peerless lake, range 5, and caches of provisions were arranged for on Peerless lake, on Otter lake in range 13, and on the Peace river at the mouth of Whitemud river, in range 21. Arrangements were also made to have a sleigh road cut from Lubicon lake on the twenty-second base line, to Otter lake on the twenty-third.

The party left Edmonton, by wagons, on March 11, and were met at Athabaska landing by my packer who had been sent in some time previously in order to have certain horses from the pack-train put into harness, as it was found to be a difficult matter to secure freighters to go in the required distance, except at very advanced rates; however, as arranged, the sleighs were ready and the party left Athabaska Landing by way of Athabaska river, on March 16, passing Fish Camp, Calling lake, Rock Island and Pelican or Wabiskaw mountains en route.

The road up the southern slope of these hills is well located but, from the summit to the foot of the northern slope, the locator evidently had little or no regard for grades, steep pitches, or sharp turns, which are far too numerous, and, moreover, are not necessary. However, the party succeeded in overcoming these obstacles, and reached Wabiskaw on March 22. After making some necessary repairs, we continued our journey northward, following the winter road put in by the Hudson's Bay company and Messrs. Revillon Bros. to the Trout Lake trading post. This was the last outpost of a very limited civilization, that we were to visit for some time.

From this place our route followed the east shore of a small lake, locally called Trout lake, to where a stream flows into it at the northeast extremity, and thence up this stream and across a small lake locally known as Island lake. A trail was cut from the north shore of this lake to the east side of Quitting lake and camp was established near the north shore of the latter. By observing, it was ascertained that the camp was very near the latitude of the twenty-third base line.

Our sleighs were sent back from this place, and a trail started eastward to the starting point of the survey on the fifth meridian, and as the snow was still from one to two feet deep in the woods the task was a very laborious one. It was not until April 8 that the party were in a position to start the base line westward.

During the first few weeks the work was rather slow and disagreeable on account of the deep snow, and on April 11 a violent snowstorm prevented work for two days.

Peerless lake, or, as it is called locally, Trout lake, situated in range 5, was reached on May 4, which was not a moment too soon, as the ice was beginning to be very much honeycombed, especially along the shores. In order to reduce the danger to a minimum the line was produced across the lake on Sunday, and the camp moved to the west shore.

The cache previously arranged for was found to be about twenty chains to the south of the line, in an excellent position and in good condition.

Peerless lake is a very fine sheet of water, from three to six miles wide, and from twelve to fifteen long. A small creek, navigable for canoes, connects the southern

end of the lake with another small lake, on the southern shore of which is situated the Trout Lake trading post. There are no rivers of any size flowing into either of these lakes, and, judging from the appearance of the water and the depth of the larger lake, they are probably fed by large springs. The water was clear and good and not at all like the muskeg drainage, which, with the exception of the water in Peace river, was what we had all along this line. Both this lake and the one to the south are said to teem with fish; bull trout, lake trout, pike, whitefish and sucker are said to be abundant, and the fact that several families make this lake their headquarters would seem to confirm the report.

The country between this lake and the fifth meridian is largely burnt-over muskeg and low ridges, and the soil on the ridges is generally sandy. In a large measure this description applies to this section as far as range 18. Muskeg and windfall were the predominating features. The valley of Loon river in range 9 was, at the time of my visit, one vast muskeg and in many places a shaking bog, but along the west bank, not more than half a mile distant from the river, was found the first good horse feed of the season, on June 3.

The river varies in width from one to one and a half chains, and is from one to three and a half feet in depth, with a current of from two to three miles per hour. The water very markedly indicates its muskeg origin, and I was credibly informed that the muskegs increased in area and softness farther north, and all the country to the south draining to this river is more or less muskeg.

The party lost a week, getting around the muskegs on the west side of Loon river, as it was found necessary to follow an old trail south along the river to Loon lake, and thence along another trail to the west of the muskegs.

I was fortunate in being able to secure some assistance in packing through this country, as the flies at this time were extremely bad, and the help in packing gave our ponies a chance to hold their own.

The shores around Loon lake are largely muskeg and windfall, and are very marshy along the water's edge, but they support a very vigorous growth of marsh grass and redtop, from which many hundreds of tons of hay could be cut.

The cache on Otter lake was reached on July 6, and the supplies were found to be in fair condition, but in the immediate vicinity of the lake horse feed was very scarce. This cache was found to be about one mile north of the base line and in range 13, in place of range 15 as shown on the maps.

From Otter lake to range 18, the country was all muskeg and ridges covered with very heavy windfall. The extremely dry season was of very material help to the party in getting through this part of the country.

In range 18 the line approaches the valley of Little Cadotte river, where muskegs are not so numerous, and the soil appeared to improve. From range 18 to Peace river are many fine plateaus, although the valleys of creeks flowing into the Peace are, as a general rule, very rough and broken. There are, however, many patches of good grass, redtop and pea-vine, and a few clumps of large spruce and poplar. In many places to the south of the base line there is heavy windfall. The line followed the Cadotte valley to section 32, range 20, and was so very rough and broken by slides and windfall that the levels were taken along the creek bed, to save both labour and time.

The Peace valley, where it is crossed by the base line, is exceedingly rough and broken, with cut banks, windfall and brush, and there is no grass to speak of. The plateau on the east side of the Peace is a rather fine tract of country and, if accessible, many fine ranches for cattle and horses could be selected, especially in townships 88 and 89, ranges 19 and 20. These townships would be almost ideal locations, as there is sufficient good level land to raise all the hay required, and the broken country is generally very good grazing land, and affords good shelter in rough weather, while the two branches of the Cadotte provide an abundant and permanent supply of good water.

Peace river is from one-half to three-quarters of a mile wide at this point, with several islands along its course. Water was low at the time of my visit, and was falling at the rate of about one foot in three days. The banks on either side are generally gravelly and stony, with many patches of quicksand, and many very large gravel bars and sandbars projecting into the water. The banks at this time of the year averaged from fifteen to eighteen feet above the water.

No minerals of economic value were seen along the river, but some drift coal and many curious fossils, probably of the Carboniferous age, were noticed among the drift that littered the shores. The river has a current of three to four miles per hour and, at the time of my visit, would range in depth from ten to twenty-five feet. There are very few fish, and the water until it begins to freeze up, has a decidedly milky appearance, but is fresh and good to the taste.

Arrangements were made previously to have a boat awaiting our arrival, and our cache was placed at the mouth of Whitemud river. Everything was found to be in order on our arrival.

The transfer of the pack-train was our most serious difficulty, and to reduce to a minimum the chances of losing our ponies, it was decided to take them across one at a time, and after a strenuous day, they were all landed without accident.

The side of the valley to the west was covered with a fair growth of birch and poplar with a few large spruce up to eighteen inches in diameter. Within a quarter of a mile of the top we again ran into muskeg which, however, did not extend far, ending in range 21. The country along the base line in the west side of range 21, through range 22 and south of the line in ranges 23 and 24 is a very fine tract of land, rather open and dry, generally covered with good grass and having sufficient timber for fences, buildings and fuel. This tract extends south practically to Peace river. Range 25 is largely muskeg which extends to the foot of Clear hills, where the sixth meridian was reached, and the twelve miles north along the meridian were largely muskeg and windfall, the few open patches along the creeks being exceptions.

While camped in range 23, the party were forced to retire on account of forest fires, which had apparently been raging for some time, as the air had been filled with smoke for several weeks. On the evening of September 28 the explorer returned and reported that the country to the south was all on fire, and that the fire was within one and a half miles of the camp, and was coming in our direction. At day-break the following morning we pushed our way to the south over the burning and burnt lands to safety. O few of the horses were scorched a little and the whole party was thoroughly smoked, but otherwise we suffered no harm. Rain fell two days afterwards and the fires, although not entirely extinguished, were checked so that we were able to proceed with the line. Through the burnt country, work on the line and trail was reduced to a minimum, as in many cases windfall and brush were cleared off in a most thorough manner.

The twenty-third base line was completed to the sixth meridian on October 11, and we had the good fortune to meet Mr. J. R. Akins, D.L.S., who was surveying the base line from the west.

The sixth meridian was produced north twelve miles by October 26, but provisions were running low, and the horse feed was very scarce and poor, the summer frosts apparently having injured it before maturity, and as winter was apparently coming on, it was decided to close work for the season. Before leaving, a good cache was erected one-half mile west of the end of the line, and a sleigh road was cut to connect with the road from Bear lake to Peace River Crossing.

The party started for Edmonton on October 25. Small lakes and streams were covered with ice that would carry a man at this time, but ice was still running in the Peace on November 1 when we reached that place. It was therefore found necessary to arrange for wintering the pack-train on the west side of the river, and, accordingly, Mr. Sutter was engaged to take it to the valley of Whitemud river, as this locality had not been burnt over, and grass was both abundant and good.

In all, one hundred and sixty-two miles of line, twelve of which were on the sixth meridian, were surveyed between April 8 and October 23.

Observations for azimuth were taken along the line on all possible occasions, and some two hundred were secured throughout the season. During the months of June and July a hazy sky rendered observing most difficult, as even after sunset the Pole star was most difficult to find.

Throughout the season, rabbits, partridges, spruce hens, willow grouse and prairie-chickens were seen in large numbers. Bears were noticed all along the line, and moose were fairly numerous, and along the valleys of Peace and Cadotte rivers, red deer were noticed. Waterfowl were quite numerous on all the small lakes and streams.

The climate in this locality is very similar to that of the country farther south. The summer was very dry and hot, and flies were very bad indeed. Summer frosts were prevalent, doubtless owing to the large tracts of muskeg to be found everywhere along the line, but the country along the Peace, and more particularly along its west side, would be very good for mixed farming; horses and cattle, it is thought, would do especially well.

APPENDIX No. 29.

ABSTRACT FROM THE REPORT OF G. H. HERRIOT, D.L.S.

SURVEY OF PART OF THE PRINCIPAL MERIDIAN.

I left Ottawa on April 28, 1912, and proceeded to Edmonton, where I spent several days in conference with Mr. A. W. Ponton, D.L.S., from whom I received much valuable information with regard to the production of the principal meridian. I then returned to Winnipeg and proceeded to organize my party.

On June 4, with a party of sixteen men, I left Selkirk on the Northern Fish company's steamer *Wolverine,* and reached Warren's landing on the 6th. There we transferred to the Hudson's Bay company's boat *The Highlander,* and proceeded down Nelson river to Norway House. On June 8, after hiring two Indian guides, we left for the scene of our season's work. As our canoes were heavily loaded, and most of the men without experience in canoes, and as Little Playgreen lake was very rough, I was compelled to hire the Hudson's Bay company's launch to tow us across the lake. On the 10th we camped on the east side of Nelson river at a point from which we intended to go into the northeast corner of township 60, range 1, west of the principal meridian. The following morning we made up our packs, and, guided by the two Indians, we set off. That was a terrible day for the inexperienced men, but after travelling about seven or eight miles we finally reached the starting point for our season's work.

I had ordered my supplies as early as possible from the Hudson's Bay company at Winnipeg, giving instructions to ship them by the first trip of the steamer *Wolverine* to Norway House. These goods went up on the same boat as my party, so that no delay was caused by waiting for them. They were all moved by my own canoes from Norway House down to the camp on Nelson river. When leaving Winnipeg I left orders for a second shipment of nearly five tons of supplies to be sent to Cross Lake post. These were shipped to Warren's landing by the Northern Navigation company's steamer, there transferred to the Hudson's Bay Company' boat, and taken down across Big Playgreen lake to Whiskeyjack portage. They were there unloaded from the steamer to a white boat, rowed to shore. loaded on a wagon, and hauled across the portage, a distance of about six miles, where they were again unloaded and placed on a York boat and rowed to the Cross Lake post, a distance of about twelve miles. Here they were again unloaded and carried up to a store tent. From this tent my canoe men from time to time drew their supplies, and so long as the work was in the vicinity of Cross lake this was a simple matter, but when the canoes had to go around to Sipiwesk lake it was necessary to send practically all the canoe men with four loaded canoes around from the post.

On June 12 the production of the line was commenced, after first correcting the position of the northeast corner of township 60, and from this time on the work was continued with as little delay as possible. On June 19, Nelson river was reached and, within the next six miles of line, nine channels of the river were crossed. On August 2 the line reached Cross lake where, after a series of triangulations across various arms and bays of this lake, we finally reached the north shore on August 10. A wide strip of country was next crossed, with no waterways until, on September 3, Sipiwesk lake was reached. In this lake we also encountered innumerable bays, channels and islands, necessitating the measurement of many triangles. On the

24th, the north shore of this lake was reached, and the line was produced about five miles farther by the 30th.

On October 1 we broke camp and started back to Warren's landing, arriving there on the 10th, and sailing from there on the steamship *Wolverine* the following day. We arrived in Selkirk on the 13th, and the following day I paid the men off.

METHOD OF CARRYING ON THE WORK.

The work of producing the line and of taking the necessary observations was carried on by myself, while to the two assistants and the chinamen was left the work of chaining, check chaining, levelling and check levelling. The first assistant, with one of the chainers, did the chaining and check levelling, while the second assistant did the levelling and check chaining. The work of bringing supplies down the river from Norway House was left to the head packer. He, together with five men, also had charge of the work of moving camp, but in order to assist him as much as possible, on moving days every man packed his own bed and clothing, together with the sleeping tents, to the end of the cutting or possibly right through to the new location for camp. The packers would bring up part of the cook's outfit and pitch camp, then return for another load. In order to keep the supplies up with the work the packers would take a load or two ahead the day before we expected to move, then the day after moving they would probably have the remainder to bring up to camp, as well as a load to move on ahead. In this way six or seven men were able to keep sufficient supplies in camp. The rivers and creeks were utilized as much as possible, and the supplies moved along them in canoes to the nearest point to the work, and from there packed into the camp. Whenever a wide stretch of country was crossed without watercourses that could be followed, it was necessary to send the packers, who were all good canoemen, around with supplies to a point where we expected the meridian to strike the next waterway, and not infrequently the packers would be away for two or three days; in one case they were away for five days. During these periods if camp had to be moved, everyone had to make a second trip and so no cutting was done on the line.

NELSON RIVER.

The whole area covered by our season's work is drained by Nelson river, and the various creeks and streams that are tributary to it. This river carries the overflow waters from lake Winnipeg and the immense territory that pours its waters into that lake. Where all the water is confined to one channel it is nearly a quarter of a mile wide, but this seldom occurs as the river is noted for its intricate maze of channels. Its water divide from Great Playgreen lake, part taking the East and part taking the West channel. Each one of these channels has its different widenings forming lakes, or its branchings forming a net work of channels, but they finally converge to pour their combined waters into Cross lake, a very picturesque lake with innumerable bays and islands. The waters from this lake find their way northward through a continuation of Nelson river, and after a devious course at length empty into Sipiwesk lake, the most beautiful of all these northern lakes. Although the Indian name 'Sipiwesk' implies a lake with many hay marshes along its shore, these marshes do not in any way detract from the natural beauty of such a body of water. This lake is much like Cross lake with its many islands and deep bays and channels, except that the channels are much narrower, and therefore show a much more marked current. One interpreter informed me that Sipiwesk meant a lake of rivers or channels. This interpretation is very applicable.

As already stated, the Nelson is a river of many channels, carrying an immense volume of water, its total discharge being almost as great as that of the St. Lawrence.

Between the point at which the meridian first crosses the river and Sipiwesk lake there is a total fall of 104 feet. Part of this great fall is distributed along the various reaches of the river. The remainder is accounted for by the many small rapids and several larger falls. In travelling from Norway House, Sea River fall is first met, with a clear fall of about 5 feet, then Sugar fall is reached where the fall is nearly 6 feet. Three other smaller rapids are met between there and Cross lake. Between Cross and Sipiwesk lakes the falls in the order in which they occur, and their heights are as follows:—

Ebb and Flow rapids	11 feet.
Whitemud fall	20 feet in fall and 10 feet in swift water below.
Bladder rapids	10.6 feet.
Over-the-hill rapids	9.5 feet.
Redrock rapids	10.5 feet.
Chain-of-rocks rapids	1.2 feet.

When one takes into consideration the enormous volume of water flowing over these rapids and falls it is not hard to realize the possibilities of this river for power production but, on the other hand, the number of these rapids and the falls, together with the fact that the fall between Norway House and Hudson Bay is approximately seven hundred feet, leads one to conclude that navigation of the river is not feasible for boats of large capacity.

Since the early years of the fur-traders, Nelson river has been used as a channel of entry to the interior of the country, and for years York boats have been taken up and down the river. Some of the rapids are run, while others must be passed by portaging. To the Indians in theYork boat such rapids as the Sea fall and Sugar fall are points of welcome excitement when going down stream. They row wildly to the edge of the fall and then lie back as their frail craft plunges into the troubled waters below. It is, however, with a very different feeling that they near it when rowing up stream, for they know that in this case it means the arduous task of portaging.

CHARACTER OF THE COUNTRY.

The country through which the meridian passes is sufficiently uniform for a few general statements describing its character. The surface is usually nearly level or undulating, being made up of a regular succession of swamps, muskegs, and low rocky ridges. The swamps are largely spruce and tamarack, with water standing from three to twelve inches deep, and covered with a stunted growth of timber. We also encountered frequent moss swamps where little water is found, and where the surface is covered with a thick layer of moss and with spruce and tamarack timber. The rocky ridges are mostly of granite formation and run in a northeasterly and southwesterly direction. They rise gradually to a height of ten or fifteen feet above the level of the surrounding swamps.

The northeast corner of township 60, range 1, west of the principal meridian, lies on the north slope of one of the largest jackpine ridges encountered in that country. The soil is a light gravelly sand, supporting nothing but a growth of jackpine, averaging from three to seven inches in diameter. As one works northward a large tamarack swamp is met. The trees here are very much stunted and of no practical use. to the east of the line the generally level surface of the country is broken by many ridges of outcropping rock, which in some cases rise thirty to fifty feet above the surrounding level. On the west, however, the swamp stretches away off toward the river. As one nears the northeast corner of township 61, the land becomes more undulating, falling gently towards Nelson river. It is broken by frequent outcrops of rock. On these rocky outcrops small jackpine grow wherever any soil is found; this soil is generally moss-covered black muck. Near the northern limit of the township the first crossing of the East channel of Nelson river is made.

Township 62 is very much broken by channels of Nelson river, as the river there has many large islands, most of them being covered with dense wood. Poplar and spruce form a fringe about the edge of the islands, while the interior is not so heavily timbered. Frequently, muskeg is encountered even on these islands. The soil, however, is much more suitable for agriculture, being in many places clay covered with a vegetable mould. In section 36 of this township the Nelson is crossed for the last time as it flows westerly.

Farther north in township 63 the swamps seem to become narrower and the recurrence of swamps and jackpine ridges become more frequent. The rocky out-croppings almost entirely disappear, although the rock comes to within a few inches of the surface on the summit of each jackpine ridge. The surface soils vary from a deep black muck in the swamps to a yellow clay on the ridges. This clay area would seem to indicate that this belt is really an extension of the great clay belt of northern Ontario. At the northeast corner of the township the line crosses a shallow, irregular lake about three miles long and two miles wide. Its waters overflow through a shallow meandering creek about a chain and a half wide, which, after a winding course of about two miles, finds its way into a branch of the Nelson not far from where that river expands into Pipestone lake. The latter is a rock-bordered lake, about five or six miles long and of nearly the same breadth.

The surface of township 64 is much more irregular, the southern portion being broken by high rocky ridges and intervening valleys. The northern portion, while less rolling, is still broken by the recurrence of rocky out-croppings and swamps. The soil is clay on the slopes of the ridges and black muck, covered by moss, in the swamps. Two small lakes occur close to the line and a third is crossed in section 36.

Throughout township 65 the surface of the country becomes more undulating and the swamps do not seem to be of so great extent. Even their character seems to change, and the tamarack swamps with much standing water seem to give place to the drier moss swamps covered with spruce, and broken more frequently by jackpine ridges. The soil, too, is of a better quality, clay loam being found in many parts. In section 36, Cross lake is reached. This lake is a long irregular body of fresh water surrounded by a rocky shore line. It is about six miles wide and probably fifty miles long, and is dotted with innumerable islands, many of which are very large. They are usually rock bordered and covered with a dense growth of jackpine and spruce, some trees reaching a diameter of sixteen inches. The lake abounds in whitefish, and is essentially an Indian paradise, with lots of wood and plenty of fish.

About fourteen miles southwest of the northeast corner of the township, and located on the shore of Cross lake, is the Hudson's Bay Co's trading post known as Cross Lake post. On the east side of the channel the Hudson's Bay Co., have erected three log buildings. One of these serves as a storehouse, the second as a store, and the third as a residence. In addition, two other traders have established trading posts at this point. North of the Hudson's Bay Co's store, Mr. Hire has established a post, and south of it along the lake, Mr. Mercer trades and barters for the Indians' furs. The best of relations exist between these rival trading houses. The welfare of the post is zealously cared for by Methodist and Roman Catholic missions, each one having a school in connection with it. On the opposite side of the channel lies a large island which either has been or is to be set aside as an Indian reserve, and here about four or five hundred Indians live during the summer, during which period the men are mostly employed on the Hudson's Bay Co's York boats, while the women spend their days in catching what few whitefish are running, for their own food as well as that of for their sleigh dogs. About the middle of September in each year these families leave for their various hunting grounds, and spend the winter hunting and trapping; and a rich harvest some of them make, for fur-bearing animals are plentiful and up till the present they have been practically unprotected.

The whole of township 66 lies in Cross lake and what land area exists is formed of islands covered with abundant growth of spruce and jackpine.

The meridian strikes the north shore of the lake in section 1 of township 67. This township is mostly low lying and very wet. The soil is largely black muck. Across the northern part of the township, where higher land is encountered and the country has not been so wet, bush fires have swept, so that this area is covered with the standing fire-killed trees.

As we worked northward into township 68 the burned area gave place here and there to tamarack swamps where it was too wet for the fire to run. The soil, too, seems to improve, and more clay is found.

Township 69 is more broken by small lakes than the one previously described. In section 18, east of the meridian, lies White Rabbit lake, a small lake with an outlet to the north leading to Sipiwesk lake. The country is covered largely with fire-killed trees, except where tamarack swamps intervene. The soil varies from a deep black muck to a heavy clay. In the northern part of the township Sipiwesk lake is first encountered. Sipiwesk is like Cross lake in that it is broken by innumerable islands, channels and bays. It is about twelve and a half miles from shore to shore along the meridian, and roughly thirty miles long. Many of its islands are covered with dense spruce, some trees reaching sixteen to eighteen inches in diameter. In some of the narrower channels of the lake the current is quite perceptible. Along a few of the islands large hay marshes occur. Whitefish and sturgeon are plentiful.

Townships 70 and 71 are broken by the many channels of Sipiwesk lake. The islands are largely covered with dense spruce. The soil on them is a deep clay except in the swamps, where black muck appears. In section 36, township 71, the north shore of Sipiwesk lake is reached.

The surface of township 72 is generally undulating, being covered mostly with fire-killed spruce and, in the hollows, tamarack swamps occur.

Throughout the whole of this area which the meridian traverses, fur-bearing animals are very numerous. Beaver, mink, muskrat, marten, red, black and cross foxes, lynx, wolves and otter are trapped in great numbers by the Indians. Moose are very plentiful, and provide the major part of the Indians' winter diet. Small birds are not numerous, but partridges are very plentiful, and wild ducks and geese frequent these waters in summer. Whitefish abound in the waters of all the larger lakes, such as Sipiwesk, Cross, Playgreen and Butterfly lakes, and also in Nelson river. Sturgeon were for years caught in large numbers in Sipiwesk lake, and I believe they are still to be found there in great numbers, although the sturgeon fisheries which were in operation on that lake a few years ago, have since been abandoned.

In conclusion, a brief summary of the various rapids to be passed between Norway House and Sipiwesk lake, with the approximate length of portage required to pass each, might be appended:—

Name.	How passed.	Description.
Sea River fall	Portage	About 150 feet long over a rocky island or by a shore route 15 chains long.
Sugar fall	Portage	On west side about 300 feet long over a rocky shore line.
Three small rapids	Portaging or tracking	Over short islands.
Ebb and Flow rapids	Portage	About one-quarter of a mile long.
Whitemud fall	Portage	Nearly half a mile long.
Bladder rapids	Portage	About one-quarter of a mile long.
Over-the-hill rapids	Portage	Only about 300 feet long, but over a hill 30 feet high.
Redrock rapids	Portage	Either: (1) By two short portages and then hauling the canoe over a high rocky hill, 30 feet or 40 feet high, or else letting it down by a line after lightening it; (2) portage about three-quarters of a mile long, with a hill 40 feet high at the north.
Chain-of-rocks rapids	Portaging or tracking	A short portage.

From the foregoing list of portages it is quite apparent that the work of transporting supplies in summer from Cross Lake post is quite a difficult one.

The winter transportation is even more serious still, for during the winter months dogs are the only means of transport or travel, and unless one has a base of supply fairly close at hand, this is a very expensive means. Moreover, dogs are hard to obtain and very expensive to buy, the price ranging from $25 to $30 each.

APPENDIX No. 30.

ABSTRACT OF THE REPORT OF A. LIGHTHALL, D.L.S.

SURVEYS IN THE NEW WESTMINSTER DISTRICT OF THE RAILWAY BELT, BRITISH COLUMBIA.

I received your instructions dated May 1, 1912, at Vancouver, and, in accordance therewith, I immediately organized my party and proceeded to Woodhaven, where my first survey work was located. The place is about eight miles from Vancouver, situated on the north arm of Burrard inlet and easily reached by steamers which make daily trips up the North arm. It is being laid out as a townsite, and is intended as a summer resort. The land is comparatively level and is covered with heavy bush, though most of the valuable timber has already been removed. Numerous skid roads have been built during the logging operations and, being still in a state of good repair, will probably be used as streets for some time. Part of this townsite lying close to the shore has already been disposed to private parties, and about a dozen houses have been built and are occupied during the summer months by their owners.

I next moved my party to Hope by railway and thence by pack train up Silver river to survey timber berth No. 554. There is a very good pack trail up this river, but pack horses are a little difficult to obtain just when they are needed, making transportation uncertain and expensive. The river is fairly large, being about one hundred feet wide and two or three feet deep near its mouth. The current, however, is very swift and the river is entirely unnavigable. It provides good fishing as it contains numerous fine, large trout. The river flows through a valley which varies from one-quarter to one mile in width. The bottom of the valley is very heavily timbered with cedar, fir and hemlock, some of the cedar reaching a diameter of thirteen feet. The hills on either side are very steep, and the timber thins out rapidly as one ascends. These hills rise to a height of five to six thousand feet, and some of them are covered with snow the whole year. No fires have ever run through this valley, and the land appears to be fairly fertile and will, no doubt, make excellent agricultural land when the timber has been cleared off. The Provincial Government is now building a fine automobile road up the valley, which will eventually connect Hope with Princeton, and afford future settlers an excellent means of communication with the outside world. At present the only inhabitants of this valley are a few trappers who catch bears, muskrats and marten.

I completed the survey of four blocks of this timber berth and also traversed the right bank of the river across section 5, township 5, range 26, west of the sixth meridian, and thence moved back to the north arm of Burrard inlet, to the survey of timber berth No. 555, which is situated in township 6, range 7, west of the seventh meridian. Several timber berths had already been laid out in this locality, but on retracing some of the lines I found that the old surveys were very much in error, and consequently I had to lay out timber berth No. 555 considerably larger than my instructions called for. This group of timber berths is laid out along the valley of Grand creek a stream about thirty feet wide and one foot deep at its mouth. In the last half mile of its course it descends about eight hundred feet and water-power has been developed on it to run a quarrying plant on the shores of the inlet. Above the falls is a basin of considerable extent where logging operations are now being carried on in timber berth No. 270. The land here will never be of much use for agricultural purposes after the timber has been taken off, as it is very rough. Around this basin the hills rise steeply to a height of about four thousand feet, the timber growing up to about three thousand feet, and the tops of the hills being quite bare.

After finishing timber berth No. 555, I moved to Pitt lake to the survey of timber berth No. 557. This lies on the west shore and about two miles from the head of the lake and, like most of the country around Pitt lake, is very rough and mountainous. The hillsides are covered with a fair growth of timber, but I should judge that the logging would be a rather difficult operation on account of the steepness of the hills. DeBeck creek enters the lake just to the north of this berth. This stream is about fifty feet wide and two feet deep, and as it has a good fall considerable water-power could be developed. Game is plentiful in all these mountains, but is very hard to get on account of the dense undergrowth. The creeks contain a considerable quantity of fine trout.

From Pitt lake I went to Sumas prairie in township 19, east of the coast meridian. The survey here consisted of the traverse of Anderson creek and Sumas river across lot 224, group 2. The country is perfectly flat and is covered with grass. It makes excellent grazing land but is subject to overflow from Sumas lake when the water is high, and is not used for agriculture to any great extent. It is well settled, the farmers going in for cattle raising on a limited scale. When it is dyked it will no doubt develop into a fine agricultural district.

From Sumas prairie I went by boat down Sumas and Fraser rivers to Langley townsite. This was orginally intended for the capital of the province and contained a court-house, jail, and several other public buildings, but when the capital was moved to New Westminster, the town was abandoned, and very few traces of the old buildings are left. The land is mostly wooded and is comparatively flat, and the lower portions are subject to overflow from the Fraser, but can be reclaimed by dyking, and made into good agricultural land. There is a peat marsh, however, in the northwest corner of the townsite covering about one hundred and fifty acres which will never be any use for agricultural purposes, the moss and peat going down to a great depth. Five of the original settlers are still on the land and the townsite was divided into six lots of about one hundred and forty acres each, one lot going to each settler; the sixth, being laid out in the peat marsh, was not claimed by anyone. The shore along the northeast corner of the townsite is being rapidly cut away by the river; in some places it has encroached over two hundred feet on the land in the last twenty years. The settlers are engaged in farming in a small way, and also depend for their living on catching salmon in the river. Grouse and pheasants are plentiful in these parts.

From Langley townsite I went to Ruby creek by railway. There I laid out fractional sections 30 and 31, in township 4, range 27, west of the sixth meridian, on the north bank of Fraser river. The land is well covered with timber, and parts of it, being fairly level, are well adapted for agricultural purposes. The best land, however, is taken up by Indian reserves, and as the Indians pay more attention to fishing than to agriculture, not much progress has been made on it. The climate appears to be a little drier and colder than it is nearer the coast, and high winds prevail, due no doubt to the narrowing of the Fraser valley.

From Ruby creek I returned to Hope, and from there went up Silver river where I laid out the remaining two blocks of timber berth No. 554. I reached there on November 18 and found that the season was becoming rather advanced for mountain work, the pack trail being considerably more difficult to travel over than on the previous trip. We were fortunate, however, in having a couple of weeks of fine weather and had just finished the survey of the two blocks when a heavy snowstorm came on which put a stop to further survey work in this district. I returned to Hope and thence went by rail to Agassiz; from there I went by wagon to section 16, township 4, range 28, west of the sixth meridian. There I laid out the southwest quarter of the section for a settler named McLean who had been living on it for six or seven years. About fifty acres of this quarter is good flat land, the rest of it lying on a hillside is of no use for agricultural purposes. A considerable amount of flat land adjoins this quarter on the east and is occupied by a very prosperous looking farming community.

On completing this survey, I paid off most of my party and took the remainder down to Westminster Junction and from there up Pitt river to township 41, east of the coast meridian. There I corrected the positions of the posts on the east boundary of section 12, and also on the east boundaries of the northwest and southwest quarters of section 12. This work was done in a heavy rainstorm, which made the trip very unpleasant.

That completed all the surveys for which I had instructions, with the exception of a small survey near Stave lake, and as I considered that this survey could be done more advantageously at the beginning of the next season, I returned to Vancouver, paid off the remainder of my party and closed operations for the season.

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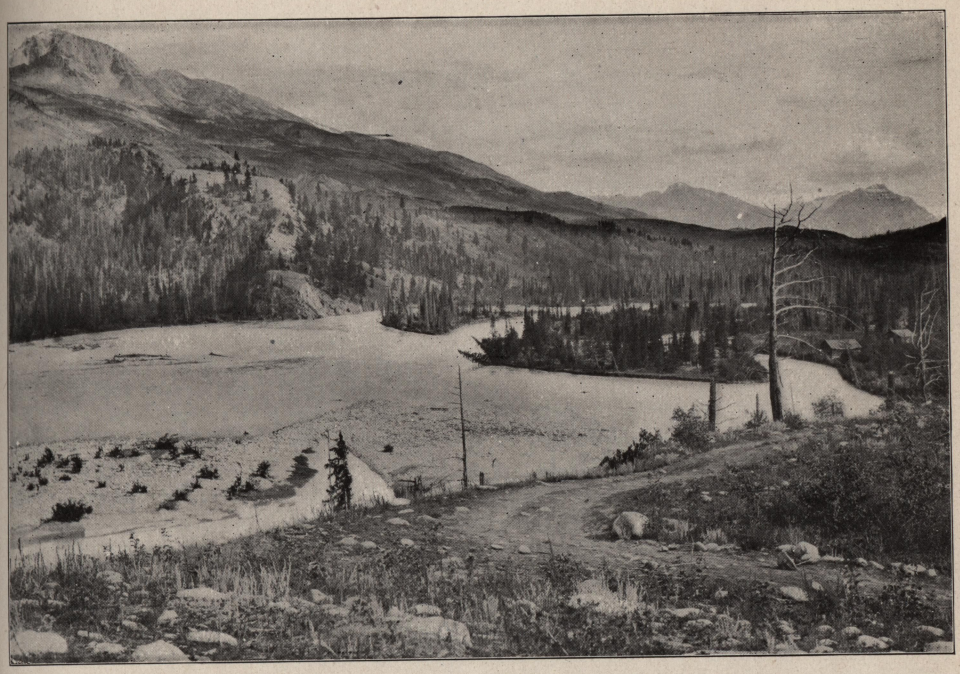

Photo by E. Deville, D.T.S.

Looking up Athabaska River, Jasper Park.

Photo by H. Matheson, D.L.S.

Fiddle Creek below the Canyon, looking towards Athabaska River.

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APPENDIX No. 31.

REPORT OF G. J. LONERGAN, D.L.S.

INSPECTION OF CONTRACT SURVEYS IN ALBERTA AND WESTERN SASKATCHEWAN.

BUCKINGHAM, QUE., February 15, 1913.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report on my survey operations of last season:—

My first work was a correction survey in townships 63 and 64, ranges 3 to 10, west of the fourth meridian. The best way to reach these townships is to follow the Cold Lake trail from St. Paul de Metis as far as the west side of Chicken hill, and from that place there is a faint trail leading north, known as the Mosquito Lake trail; it crosses Beaver river in section 5, township 63, range 8, west of the fourth meridian, and continues straight north about six miles, where it crosses the survey contractor's trail along the north boundary of township 63. The latter trail goes east to Cold lake and west to lac LaBiche trail. These townships are heavily timbered, except townships 63, ranges 5 and 6; on these there are many fairly open sections. The soil is generally a clay loam, and in a few places there are large hay marshes. There is no doubt that ranching would be the most profitable occupation for a new settler. The St. Paul settlement does not extend farther north than Beaver river. There are prospects that a railway will soon cross this district, as the Canadian Northern Railway company has already started a road north from Edmonton; last November they had 69 miles graded.

Having completed the work I returned to Edmonton and, after purchasing more supplies, I drove to Athabaska Landing, then west about forty miles to inspect two contracts. There is a good trail from Athabaska Landing as far as Baptiste lake, and from there the only trail is the one made by the contractor. Township 64, range 26 has been burnt over almost clear of everything. The land is dry and the soil a clay loam, but in township 63 of the same range it is chiefly tamarack swamp. Townships 65 and 66 ranges 26 and 27 are dry rolling country, having a clay loam soil, covered with poplar and scattered spruce from six to eight inches in diameter. When the timber is cleared from these townships they will make good farm land. I might add that the railway leading to the Peace river country, and which is now partly constructed, will pass through these townships.

Having completed the inspection of these two contracts I went to Red Deer to subdivide a township that was previously covered by Cygnet lake. On my arrival I found that the contractor who was draining the lake had met with difficulties, and had not completed his work. I was accordingly obliged to postpone the survey for the time and started to repost township 53, range 25, west of the third meridian. Saskatchewan river cuts through the southwest part of this township, and for about a mile on either side of it the land is so cut up by ravines, and is so rolling that it is fit for nothing but pasture land. The remainder of the township is fairly level, having a sandy loam surface and a clay subsoil. A number of settlers have started farming and they appear satisfied with their choice of location.

Leaving there about the end of August, I started for Heart lake, which is northeast of lac LaBiche, to inspect Mr. Davies' contract. At St. Paul I was advsed to

go by way of lake St. Vincent, thence to the forks of the big and small Beaver rivers and follow up the shore of the little Beaver until I would strike the lac La Biche trail. In my opinion it would be best to go by some other route, even if the distance was greater. From the east end of lac La Biche there is a trail that leads to Heart Lake; it goes up and down all the high hills, and a good team can haul only about 1,000 pounds on it.

This contract, comprising townships 69 and 70, ranges 10, 11 and 12, west of the fourth meridian, is high rolling country, covered with poplar and scattered spruce, six to eight inches in diameter. There are a few large tamarack swamps to be found, and many large lakes, most of which are well stocked with fish. A few families of Indians live around Heart lake and exist entirely upon fishing and hunting, no attempt having been made at cultivation, although the soil appears to be as good as elsewhere. Leaving here on September 10, I went to inspect Mr. Green's contract, comprising townships 41, 42, 43 and 44, range 7, west of the fifth meridian. I went west from Red Deer on the Rocky Mountain House trail as far as Leslieville, and from there northwest along the south bank of Lobstick creek. This trail ends in section 35, township 40, range 6. It being impossible to continue with wagons, I packed a tent, a few blankets and provisions and started cutting a pack trail, doing inspection and moving at the same time. The country is rolling and thickly timbered with large spruce and poplar, and the soil is a clay loam. The best of the spruce is already taken up in the form of timber berths, and there is a saw-mill in operation on Lobstick creek, which will do custom sawing for the settlers at reasonable rates. I might remark that it is impossible to reach these townships during summer by going west from Wetaskiwin to Buck lake. On my way in I was agreeably surprised to find such a large tract of fertile land. It was thickly settled from Red Deer west, and the farmers had a prosperous appearance. I counted seventeen threshing outfits in operation. Leaving Mr. Green's contract I went to inspect Mr. Ord's, in townships 61, 62, 63, 64 and 65, range 18, west of the fourth meridian. From Pakan to Smoky Lake post-office there is a good road, and from there a surveyor's road going north in range 17 to Buck lake and then to lac La Biche. In township 61, range 17, there is a branch trail leading into range 18, and thence northerly. Townships 61, 62 and 63, range 18. were overrun by fire a few years ago and are now either entirely cleared or covered by windfall. The soil is a clay loam, and the surface very rolling. There are a few Galician families settled on the south part of township 61, but the most of the country is still open for entry. The northern two townships are heavily timbered with poplar and scattered spruce, six to eight inches in diameter. The large number of small lakes and swamps has protected them from fire.

It might be of interest to prospective settlers to know that from Pakan, north, east and west, the country is settled almost entirely by Galicians, and judging from the appearance of the buildings and stock they are in a prosperous condition. They still retain the language and customs of the old country.

My next work was in townships 63 and 64, ranges 3, 4, 5 and 6, west of the fifth meridian, but as all roads start from Edmonton and radiate in different directions it was necessary to once more return to the capital; from there I followed the Lesser Slave lake trail to reach my destination. It was fortunate that the ground was now frozen over, for from Belvedere to Holmes crossing, during wet weather, is to be found one of the worst trails in Alberta. There is some very good land in these townships, but generally for a few miles back from the river it is chiefly sand hills, covered with jackpine, and between the hills are to be found tamarack swamps. I met no settlers located in the townships in this contract, but came in contact with an engineering party locating a railroad to strike the east end of Lesser Slave lake at Sawridge. In conversation with the engineer in charge, who had been over the country as far as the lake, he said the railway would pass through a lot of very good farm land. In November the location was passing through range 5. Throughout the contract there

were found along the creeks many large open places covered with a luxuriant growth of grass. If settlement would not rush in too quickly it would certainly prove to be a good ranch country. Holmes crossing is quite a busy place, it being the headquarters for settlement extending northwest along Freemen river from the Assiniboine flats.

After completing this work I returned to Edmonton and disposed of my transport outfit and reduced the number of my party. I then went by train to Medicine Lodge, where I engaged a team to move camp and supplies. I drove about eighteen miles north of the railroad on the trail that had been recently opened out to go to Grande Prairie and the Peace River district. As far as I could see, the country is a succession of rolling sand hills covered with small jackpine or scrub spruce, and up to the present no attempt has been made at farming. I completed the inspection of this work and then returned to Edmonton, where I paid off the remainder of my party and took the train for the East.

I have the honour to be, Sir,

Your obedient servant,

G. J. LONERGAN, D.L.S.

APPENDIX No. 32.

REPORT OF E. S. MARTINDALE, D.L.S.

SURVEYS IN SOUTHERN ALBERTA.

AYLMER, ONT., February 12, 1913.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report on my surveys in Southern Alberta during the past season.

I left Aylmer on May 9 and proceeded to Calgary, where I engaged my men and organized the party. The transport outfit which had been wintered at High River was shipped to Medicine Hat, from which place we were to commence retracement surveys. Being somewhat delayed at Medicine Hat by heavy rains and the non-arrival of freight from Calgary, we did not reach township 6, range 2, west of the fourth meridian, the scene of our first work, until May 30. Townships 6, ranges 1 and 2, were then retraced, and having received your instructions for the surveys in the mountains, the retracement work was brought to a close. The outfit was taken to Irvine, a small village on the main line of the Canadian Pacific railway about twenty miles east of Medicine Hat and from there shipped to High River.

Townships 6, ranges 1 and 2, are reached by good wagon trails through partially settled country. This country is not very productive and varies from gently-rolling to broken and hilly prairie. The soil is mostly a sandy loam from four to ten inches in depth underlaid by a hard gravelly subsoil, in some places the surface is stony. These townships are but a short distance south of the bench of the Cypress hills, and owing to the high altitude, summer frosts are a frequent occurrence; hence, this locality is unsuitable for agriculture. Almost the whole of these townships is given over to ranching, horses being raised principally. A few homesteads have been taken up in range 2 but, after one or two unsuccessful attempts to raise a crop, several of these have been abandoned. So far there is practically no settlement in range 1.

Owing to the continuous heavy rains during the first part of July we were unable to leave High River for the mountains until July 9 and even then the roads were almost impassable, the mud being axle deep. The fifth base line was produced across range 5 and two miles of range 6 by the end of July. The whole month was very wet, and the work was greatly retarded on this account.

Subdivision surveys were then carried on in townships 17 and 18, range 6, west of the fifth meridian, and Highwood river was traversed across township 17, range 6, These townships lie between the Highwood range and the main range of the Rockies in very hilly broken country. However, it is easy of access by a good wagon road from High River, which has been built and is being maintained through the mountains by the Lineham Lumber company which operates the timber berths up Highwood river.

On the base line across range 5 the timber is scrubby jackpine, spruce and poplar, and is of very little value; the remainder of the Highwood valley has been well timbered with spruce and jackpine up to twenty inches in diameter, but the valley was swept by fire in 1910 and the timber is now fit for fuel only. Coal of good quality is found in these townships, and several large claims have been taken up.

Highwood river is a swift-flowing mountain stream, from which it would be rather difficult to develop power. Mann creek, or Cataract creek, flowing into the Highwood from the south in section 34, township 16, range 5, is another swift stream with numerous small rapids and waterfalls near the river. There appears to be a fall of over one hundred feet in less than half a mile near the mouth, and power could be developed there at reasonable cost.

Game is not plentiful, although a couple of deer and some mountain sheep were seen during the summer. Partridges were not numerous.

In September the outfit was moved up Storm creek over Storm creek pass into Kananaskis valley in township 20, range 9, west of the fifth meridian. The east boundary of range 9 was run nearly to the fifth correction line, and the subdivision work in township 19, range 8, was completed.

This country is most easily reached by pack trail from Morley on the main line of the Canadian Pacific railway. Kananaskis river has its source in the Kananaskis lakes, and flows in a narrow valley between two mountain ranges into Bow river, west of Morley. The river averages from one to one and a half chains in width and has a depth of from two to ten feet. There is a waterfall about twenty feet in height two miles north of the lakes, where considerable power might be easily developed. Pocaterra creek, commencing near Storm creek pass, empties into the river about twenty chains below the falls. The Kananaskis lakes in township 19, range 9, are two very beautiful bodies of water, the northern one being about three miles in length and from one-half to three-quarters of a mile in width and the other having a little larger area, but being more circular in shape. The valley of the Kananaskis was originally well wooded but having been burned over many years ago it is now mostly covered with a thick mat of windfall and small jackpine. Coal is also found in this valley, large outcrops being visible on the mountain side to the north of Pocaterra creek. Game is very scarce in this district.

On account of the severity of the weather in October, and also owing to the fact that our supplies were getting low, we were forced to leave some of the mounding on this work incompleted. We moved back again to the Highwood valley on the 21st of the month. Heavy snowstorms were then a daily occurrence in the Kananaskis valley and there was already a depth of over two feet of snow on the passes.

The subdivision in township 18, range 7, and townships 17, ranges 5 and 6, was completed by November 18, when it was decided to close operations for the season. Accordingly, the outfit was taken to High River and the party was there disbanded. Arrangements were made for wintering the transport at High River.

Accompanied by my assistant and one chainman I then proceeded to Elkwater lake in township 8, range 3, west of the fourth meridian, to survey the townsite for which you had given me instructions.

This townsite, which is situated in the Cypress Hills forest reserve is easily reached from Medicine Hat by a well travelled wagon road; it is located at the south-east corner of the lake at the foot of the northerly slope of the Cypress hills. A contour survey had been made earlier in the season by Mr. F. V. Seibert, D.L.S., and a proposed plan, to fit the configuration of the ground, prepared in your office, from his notes. It was found that this plan was quite suitable, and it was followed, with very few changes, in making the survey. This survey being completed, we returned to Medicine Hat on January 21, 1913.

I have the honour to be, Sir,

Your obedient servant,

E. S. MARTINDALE, D.L.S.

APPENDIX No. 33.

ABSTRACT OF THE REPORT OF H. MATHESON, D.L.S.

TOPOGRAPHICAL SURVEYS IN THE FIDDLE CREEK DISTRICT.

On May 20, I arrived in Edmonton and began to outfit for my season's work. On the 27th I left Edmonton by the Grand Trunk Pacific railway for Hinton, that being the farthest point west to which the railway would haul freight or passengers at the time. I left my packer and one assistant in Edmonton to see about loading my horses and supplies on the freight train which left Edmonton the following day. My party consisted of two assistants, a cook, a packer and three labourers.

On the 28th, I hired a team in Hinton to move the part of my outfit which had already arrived to Jasper park, and I established my first camp on the east bank of Fiddle creek, about a mile south of the railroad. The remainder of my outfit and pack horses arrived three days later.

On May 29, I started topographical work south of Fiddle creek canyon. The object of this work was to locate a road up Fiddle creek from Miette Springs station on the Grand Trunk Pacific railway to Miette hot springs, a distance of about eleven miles. I did the topographical work by the transit stadia method, the same as used by Mr. G. H. Herriot in this vicinity in 1911. Traverses were run in the area covered, and from the stations of these traverses stadia readings were taken on all prominent changes in slope. The stadia readings were reduced in the field by means of a slide rule, and a sketch was made on the spot on a scale of 400 feet to an inch, and with ten feet contour intervals. These sketches were afterwards used in making the road location. A line of levels was also run from a bench-mark on the Grand Trunk Pacific railway near Fiddle creek bridge to a point above Fiddle creek canyon.

From my first camp I completed the work around Fiddle creek canyon and north of it. Then I moved my outfit to the mouth of Morris creek, a tributary of Fiddle creek above the canyon.

The work around Fiddle creek canyon was very difficult, because many parts were inaccessible. In these places points were determined by intersections, that is, bearings were taken to the points from two or more stations. Vertical angles were also read to the points and the elevations determined.

From my camp at the mouth of Morris creek, I completed the topographical work, connecting with the work done by Mr. Herriot in 1911. I then proceeded to make a road location. For convenience I started at a point south of Fiddle creek canyon, and worked south towards Sulphur creek. The location follows the mountain side east of Fiddle creek from the canyon to the mouth of Sulphur creek, where it crosses Fiddle creek and follows the east bank of Sulphur creek to the springs. After locating the road to the crossing of Fiddle creek, I moved my camp to the junction of the two main forks of Sulphur creek, about one mile and a half north of the springs, and then, from a point about a quarter of a mile below the springs, I located the road north to the crossing of Fiddle creek and south to the springs.

After completing the road location from Fiddle creek canyon to the hot springs, I moved my camp to the spot where I had my first camp. Then I started at a point east of Fiddle creek canyon and located the road northerly to the Grand Trunk Pacific hotel site. I did not locate the portion between the hotel site and the railway, as this portion is fairly level and offers no difficulties. Just south of Fiddle creek canyon the location passes around a gully with almost perpendicular rock sides.

Here the road for about half a mile would have to be blasted out of a rock fall. I did not locate this part on the ground as it was inaccessible .

I located the road as an ordinary traverse, but placed stakes every 100 feet, also at prominent changes in slope, and on these marked the chainage from the starting point. I took levels along the traverse to find the elevations of all the points marked by stakes. I also took slope readings with a clinometer across the line of traverse at the different stakes, and took notes of the nature of soil or rock to be excavated. The greater part of the road location is along fairly steep hillsides, where numerous gullies of various size and other obstructions had to be crossed. From my topographical work I knew the points where these could be crossed most easily and the positions and elevations of these points. In making the location the level work followed close to the transit work, so that the elevation of each station occupied was known very closely. In this way I could arrange my grades to cross gullies and other obstructions at the proper elevation. The maximum grade allowed was eight per cent.

A road could be made to the hot springs from Pocahontas. This would be cheaper to construct than the road laid out, although I think that a good road to the springs along any route would be more expensive than is generally supposed. From Pocahontas a road is already constructed about five miles toward the springs. This has been constructed to be used in hauling out timber for the Jasper park collieries. This road could be improved and used as a part of the route to the springs. However, the part between the end of this road and the springs is the difficult part to construct. The present road could be produced to the mouth of Morris creek and thence along Fiddle creek to a good crossing and thence across that creek to my location on the east side, and my location could then be used to the springs. I think this would be the best route, if the road is to start at Pocahontas, because, by following the west side of Fiddle creek, a large number of creeks and gullies would have to be crossed where the hillsides are steep and the nature of the ground is such that landslides and washouts would be liable to give trouble. It would, however, necessitate two bridges across Fiddle creek. There is a fall of four or five feet in Fiddle creek, a short distance below the mouth of Morris creek. Here the river bed is narrow, and a bridge could be easily constructed over the falls. Or probably some more suitable crossing could be found between Morris and Villeneuve creeks.

The route above described would not include the scenery around Fiddle creek canyon, but a branch road could be built from some point on this road to the canyon. This route could, however, be made to include the "Punch Bowl" falls, a short distance from Pocahontas, and probably a very pretty falls, 25 or 30 feet high on Morris creek, about a mile above its mouth. This route would undoubtedly be cheaper than the route I laid out by Fiddle Creek canyon. But, if constructed, the hotel site would have to be changed and some point in the vicinity of Pocahontas chosen. There are two reasons for this. In the first place the distance from the present site to the springs by that route would be too great, and in the second place, if the present site were used, Fiddle creek would have to be crossed to go to Pocahontas, and to bridge Fiddle creek below the canyon would be impracticable. The bed is too wide, and at flood times the creek spreads over the whole bed.

The part of the road already constructed from Pocahontas climbs to the top of a divide. From there it would have to be run down again through an elevation of over 400 feet to cross Fiddle creek, and of course this elevation would have to be climbed again. Almost all such extra climbing would be avoided on the route by the canyon. The route from Pocahontas would also be longer than the canyon route.

By whichever route the road is constructed, there will be considerable clearing to do on the right of way, as almost the whole country is covered with brulé. In many cases this brulé is intergrown with small jackpine, and trees over eighteen inches in diameter are quite frequent.

I may say that the contour work which I did was done with a view to locating a road from the present proposed hotel site to the springs so as to include the scenery around Fiddle creek canyon on the route. I had no time for any other. However, some of this and some of the work done by Mr. Herriot in 1911 would be useful in investigating other routes.

I consider that the canyon route, along which I made my location, would give the best road, both for roadbed and scenery, also for grades. But I think a cheaper road can be built from Pocahontas. From my plan and profile and accompanying notes, an estimate can be made by an engineer as to the cost of construction by the canyon route.

I completed the location of the road on September 28. I then moved my outfit by wagon and pack horses to Hinton, and took train to Thornton where I was instructed to make some subdivision surveys near the headwaters of Wolf creek, to tie in a location line of the Canadian Northern railway.

At Thornton I hired pack horses to supplement my own pack outfit and, on October 5, I left there, following a trail which runs along Wolf creek up to its source and thence southerly towards the Pembina and Brazeau rivers. The trail also follows close to the Canadian Northern railway location lines. Although generally good, this trail passes through some bad muskegs, which gave me considerable difficulty on my first trip from Thornton, and the horses were mired many times. After the first two trips over the trail, the weather became cold enough to freeze the muskegs.

I established my first camp in township 50, range 18. This was not within the area to be surveyed, but some of the lines to be surveyed were accessible from this camp and I decided to start work from there, because I arrived late at night, and I did not think I had enough supplies to spend another day on the trail. The following day I sent the packers back for more supplies.

My last camp on this work was near the place where Wolf creek crosses the thirteenth base line. From this camp a return trip to Thornton by pack horses occupied about eleven days. As practically all the horse feed had to be hauled from Thornton, I found it almost impossible to keep up supplies by pack train, so I decided to use flat sleighs. I started using three sleighs about the middle of December, travelling on the ice on Wolf creek as much as possible. I found that I could haul more on three sleighs than my eight horses could pack, and also found flat sleighs a very satisfactory means of transportation, especially when they can be used on the ice on lakes or rivers.

The country surveyed consists mostly of ridges with shallow muskeg between them. The land on the ridges is more or less sandy, often sandy loam. Some ridges are very sandy and grow no timber but jackpine. The subsoil in the muskegs is, of course, similar to the ridges. Many of the muskegs could be easily drained and would make the best of land. The timber found consists of spruce, jackpine, tamarack, some poplar, balm of Gilead and willow. There is very little timber of commercial value, because in the past forest fires have been too frequent to permit of a large growth. Both ridges and muskegs are timbered.

Very little game was seen, except grouse and rabbits, althugh moose tracks were seen. The rabbits were very numerous, and it was common to see hundreds of them around camp at night. They were very destructive, and would even eat tripods and axe-handles. I do not think that fur-bearing animals were numerous, as no trappers were operating in the area surveyed, except a few Indians, who spent only a few days and passed on. Trappers operating in the vicinity find lynx to be the most profitable fur-bearing animal in the district. Weasel are also found and trapped, and there are also muskrats in the lakes and streams.

I made surveys in township 50, range 17, and townships 48 and 49, ranges 16 and 17, west of the fifth meridian, but I was not able to complete all the work for which I had instructions. On December 28 my packers arrived in camp on their first trip with flat sleighs, with a load of supplies. They were delayed on the road from Thornton

because they had to cut out much timber which had fallen across Wolf creek since flat sleighs were last used on it. In the mail which I received there was a telegram ordering me to close operations at once. As my packers had just brought in a load of supplies, I could not take back this load and all my camp outfit at once, so I sent out half of my party and left the remainder to complete the mounding . After the first half of the party arrived in Thornton, I disbanded the men, and sent the packers back for the rest of the outfit. The remainder of the party arrived in Thornton on January 28, 1913, and I disbanded them, retaining only the packers to take the horses to Ray, Alta., where they were wintered with Mr. A. McDonnell. On February 6 I left Edmonton for the East.

APPENDIX No. 34.

ABSTRACT OF THE REPORT OF P. MELHUISH, D.L.S.

SUBDIVISION SURVEYS IN THE KAMLOOPS DISTRICT OF THE RAILWAY BELT, BRITISH COLUMBIA.

After receiving my instructions, I left Vancouver on May 11, 1912, for Spuzzum, to make surveys in township 8, range 26, west of the sixth meridian, and to survey timber berth No. 552. The first camp was made in section 36, near Spuzzum station, which is on the main line of the Canadian Pacific railway, about 114 miles east of Vancouver. As the old Yale and Cariboo road is entirely obliterated in a great many places along the Fraser canyon, the railway is the only means by which the northerly half of this township can be reached. This road has, however, been repaired in places to a certain extent by the Canadian Northern railway contractors and it is possible to travel by wagon from Yale to a siding known as Saddle Rock, in the southern part of the township. All the agricultural land is included in Spuzzum Indian reserve No. 1 and a few small flats outside the reserve hardly large enough in area to be considered profitable. These small flats are adjacent to the Canadian Pacific railway line and the rest of the land in the township lies on steep mountain sides, timbered with fir and jackpine, and entirely unsuitable for agriculture. No minerals of economic value were found in the township.

The next camp was made in lot 4, near the mouth of Spuzzum creek. This creek is the only one of any considerable size in the township. It flows in an easterly direction and empties into Fraser river in section 24. While working from this camp a trail was made up the left bank of Spuzzum creek. An old trail was found, but it was necessary to cut parts of this out again and to do some mattock work on the steep side-hills. After finishing the subdivision work, camp was moved up the creek in order to continue the survey of timber berth No. 552. This berth is situated in townships 8, ranges 26 and 27, and township 9, range 27, west of the sixth meridian, and lies on each side of the valley of Spuzzum creek. The berth was surveyed to include all the available timber of value not already taken up, for a distance of about eleven and a half miles from the mouth of Spuzzum creek up the north fork, and about nine miles from the mouth of the creek up the south fork. The area of the timber berth is about 4,470 acres. Spuzzum creek is a swift mountain stream with an average depth of about three feet and a width varying from half a chain to a chain. The bed is very rough and is composed of large granitic boulders. The mountains slope towards the creek at a very steep angle on each side, and for a distance of about three-quarters of a mile from where the Canadian Pacific railway crosses, the water runs through numerous small canyons. The elevation of the main forks, which are about six and a half miles from the mouth of the creek, is 1,200 feet above the Fraser. The highest falls, however, are only about twelve feet, and there is hardly sufficient water during the dry period to warrant the construction of a dam.

The old trail which we found followed the general direction of the creek from the railway line as far as the main forks. A new trail was cut out from the main forks to the second forks, on the north branch of Spuzzum creek, a distance of about four and a half miles. Another trail was made up the south fork a distance of about two miles. All the transportation up the creek was done by man packing; more work would be necessary on the trail to render it suitable for pack-horses to travel on.

The berth contains some good cedar, fir and hemlock, most of which is near the creek, but it will be difficult to get it out. The timber becomes scrubby and generally

rotten on the inside at a distance ranging from twenty to thirty-five chains from the creek

As far as the berth extends, no minerals were found, but farther up the north fork graphite has been discovered, and there seems to be a possibility of this being mined in the near future.

Bears, deer and mountain goats are found in the mountains near the creek, and brook trout are plentiful.

The survey of the berth was finished on September 19, and it occupied two days for the party to move the outfit down to the railway. The next work was the survey of the northwest quarter of section 36, township 7, range 26. There is a small flat in this quarter section which contains about five acres of agricultural land which could be irrigated from Fivemile creek.

After finishing the survey of this quarter section the party was moved to North Bend by rail, to make surveys in townships 10 and 11, range 26, west of the sixth meridan. There are five or six settlers in township 11 who have taken up lands on the sloping benches. These lands are timbered with fir, birch and alder, and in parts are easily cleared. Two settlers on the east side of Fraser river have taken up quarter sections in sections 14 and 23, where there is some good timber which would be suitable for ties. No difficulty was experienced in crossing the Fraser about two miles above North Bend by means of an Indian dug-out canoe.

A wagon road is being built by the British Columbia Government from North Bend to Chaumox, a distance of about five miles along the Canadian Pacific railway. This road will allow the settlers to haul their produce to North Bend, which is a railway town, with car repair shops and yards for making up freight trains.

There are several creeks suitable for irrigation purposes in township 11, but none large enough for generating electric power.

After finishing the work in township 11, somewhat over three miles of line were run in township 10, where a tie was made to the Canadian Pacific railway right of way. The lines in this township were over high rugged mountains, and ran round an Indian reserve and two small farms.

The next work undertaken was at Keefers in township 12, range 26, where the party was moved by rail on November 21. Camp was made opposite Keefers station, and slight trouble was experienced in obtaining wood. The work undertaken lay in section 30 on both sides of the Fraser, which was crossed by means of the cable owned by the Canadian Northern railway contractors. There is a small area of flat land on the east side of the river in section 30, but it would require considerable clearing, and the soil is too rocky to be profitable. It contains some good fir for tie timber.

The country seen during the season in townships 7, 8, 10, 11 and 12, range 26, is all mountainous. The most desirable land was in township 11, where settlers will, after clearing their land, be able to market their produce with no trouble. The land in all these townships requires irrigation, and after this is effected vegetables and fruit of good quality can be raised.

The grading of the Canadian Northern railway which runs on the east side of the Fraser through these townships is nearly finished, and work on the bridges and culverts is being rapidly pushed ahead. It is expected that the railway will be open in 1915, and when the progress of the past year is considered this seems quite feasible, even considering the difficulties encountered in the Fraser canyon.

There are no summer frosts in the country covered by the season's work. The first frost was on October 14, and the climate generally does not run to extremes. There is considerable rain in the North Bend country during the late autumn, but in the summer the climate is dry except in the high mountains. No minerals of any value were found, and no coal-bearing formations were seen. Bears, deer and mountain goats are plentiful at a short distance back from the railway, and salmon are

caught by the Indians, some of whom rely on this to some extent for their winter food. Grazing land is scarce, and the only cattle we saw did not appear to be in good condition for wintering.

The transport arrangements were effected by means of the Canadian Pacific railway and by hiring locally a team and wagon, as required.

The party disbanded at Keefers on December 3 owing to the difficulty of working on the mountain sides with snow on the ground.

APPENDIX No. 35.

ABSTRACT OF THE REPORT OF C. F. MILES, D.L.S.

MISCELLANEOUS SURVEYS AND INSPECTION OF CONTRACTS IN ALBERTA AND WESTERN SASKATCHEWAN.

My work during the past season consisted in the survey of timber berth No. 1900, and a settlement and Roman Catholic mission at Green lake, and the inspection of contracts Nos. 14 and 33 of 1911, and Nos. 21, 22, 24, 25, 29 and 30 of 1912, in the province of Saskatchewan; also a reinspection of contract No. 14 of 1910, in the Cold Lake district in Alberta.

We left Edmonton on May 18, 1912, and followed the trail through Fort Saskatchewan, Bruderheim, Saddle Lake and St. Paul de Metis to Cold lake, a distance of about 200 miles. I commenced the survey of timber berth No. 1900 on May 28 and completed it on July 4.

While camping along this lake, we tried fishing with a net and caught whitefish up to six pounds in weight; we also caught salmon trout up to eight pounds in weight by trolling.

There is some excellent spruce on this limit, the best and largest, up to three feet in diameter, growing on the southerly part. There is also reported to be very good timber along the river that runs from Primrose lake into Cold lake.

A good deal of smoke was observed on the north and west sides of the lake during my stay there, but what damage was done by the fires I could not ascertain. Fires also entered the berth I was surveying from the east, but did no appreciable damage to the timber, at least not while I was in the vicinity. The most damage was done amongst the smaller trees along the shore of the lake, where the high winds off the water kept the fire moving. Fires were also seen along the west shore all the time I was camping on the lake, and were said to have been started by settlers and Indians in order to increase the area of their clearings. At one time the fire came in our direction, and we had to bundle everything into two punts and get out of its way.

On July 5 my outfit left French bay on Cold lake for Green Lake settlement by way of Frog lake, Onion lake, St. Walburg and Meadow lake, a distance, by section lines, of about 230 miles. We arrived there on the 25th after having, on the way, inspected the greater portion of contract No. 14 of 1911.

Settlement ceases about ten or twelve miles north of St. Walburg, and after crossing Fifteen-mile creek, we travelled through thick woods all the way to Rabbit creek, where there is a stopping place near where trail we had been following joins the one that leads directly from Makwa lake to Meadow lake. No more settlement was seen until we got within seven miles of Meadow lake, where we found some fine stretches of park-like country partly settled by a few French half-breeds, who are engaged in farming to a small extent, and in raising cattle and horses.

Beyond Meadow lake and along the trail to Green Lake settlement new settlers have come in, who are also engaged in cattle raising. They were cutting large quantities of hay in the flats of Meadow river. This river empties into Beaver river, which has low banks below the junction. Here also much hay was being made for herds of cattle brought in from the south, where herd law is in operation.

Green Lake settlement is inhabited by a number of old French half-breeds, some of whom have resided there for many years, and most of whom are old employees of the Hudson's Bay Co. They support themselves by farming on a small scale, having

small clearings of two to ten acres. They have a few head of cattle and horses and, besides, are engaged in freighting, fishing, hunting and trapping. A fine church forms the nucleus of this settlement, which is presided over and served by a French Roman Catholic priest, who is also the postmaster and general adviser to the community. The Hudson's Bay company have an old established post there, as also have the Revillon Bros., a French concern with headquarters in France and Edmonton. Telegraph connection with the outside world is maintained by way of Battleford, and was successfully inaugurated during the past year. Trails from there lead to Prince Albert and to Battleford. The nearest railway is the branch of the Canadian Northern from Big River to Prince Albert, the distance to Big River being only about 50 miles by the canoe route.

I finished the survey of settlers' claims and the inspection of contract No. 14 of 1911 on August 17, and then left for contract No. 33 of 1911 by way of the Meadow lake and Makwa river trails. I crossed Horsehead creek on August 21 and commenced the inspection of that contract. There are several settlers along this trail. All engaged in ranching, and hay meadows appear to be plentiful. Some settlers from the vicinity of the Saskatchewan were cutting hay there, and intend driving up their cattle to winter them on Red Willow lake in township 58, range 21, west of the third meridian. On Meadow river, too, we met one outfit that had driven in over 300 head of cattle, and the men were cutting hay and putting up buildings with the intention of wintering there.

We finished the inspection of the contract on September 3 and moved south on the following day. There were heavy rains about this time and we were held up about fifteen miles from St. Walburg on that account.

From St. Walburg we drove by way of Onion lake and Frog lake to Cold lake in order to make a second inspection of contract No. 14 of 1910. I was getting very short of men and tried to hire some, both at North Battleford and Lloydminster, where I had gone to procure another supply of provisions, but without success.

On September 14 we arrived at Cold Lake post-office, where I succeeded in hiring a couple of Indians. We completed this reinspection on September 23, and left for Mervin the following day.

I returned to Lloydminster and North Battleford to secure some more help, but I had little success, as I secured only one man. I left the latter place on October 7 and rejoined the party at Mervin.

It strikes one as peculiar that north of the Saskatchewan there are so few cattle; thousands of acres are available for pasture, but no cattle are found. This I learned is the result of "herd law." If homesteaders would only fence in their little patches of crops, cattle might run at large and grow fat on the almost unlimited pasturage. As a rule, however, the homesteaders come in, do some ploughing, sow a little grain, and leave it while they attend to some other business, returning probably about harvest time. In the meantime settlers who have any stock must either herd them or drive them up many miles to the north where the herd law has not yet been introduced. It is my opinion that so long as herd law prevails, mixed farming will have to be suspended, and the extensive areas of pasturage go to waste.

Leaving Mervin on October 12, we travelled easterly by a trail to New Mervin, the present terminus of the grade of the Jackfish Lake branch of the Canadian Northern railway Thus far we found the country fairly well settled, but along the trail east of Turtle river only a few settlers were seen. When we turned east on a trail that runs south of Turtle, Stony and Midnight lakes to Birch lake, quite a number of settlers were observed, engaged mostly in cattle raising. They were busy cutting feed, for winter use, in the extensive meadows near these lakes. We reached Kellogg's ranch on the west side of Birch lake on the 13th, and Birch Lake post-office the following morning. Continuing northeasterly for about six miles we passed about half a dozen settlers. We then entered the woods on the Pelican lake trail. Journeying

along this trail 15 or 20 miles easterly and northerly we re-entered meadows, which continue northerly about five or six miles up to within a mile or two of Chitek lake. There a quantity of hay had been cut. In that vicinity there is a small Indian village, comprising about half a dozen families, who fish, hunt and trap and make hay for their horses. No cattle were observed around the village.

We continued our journey by the Green lake trail, which we followed southerly until we struck Big river, in contract No. 21 of 1912, on October 17. We camped in that vicinity, there being a considerable area of open prairie to the west of Big river, Much of the land to the north of the river consists of muskegs and marshes and there is a good deal of open country, but bush and burnt wood lie south of the river. I completed the inspection of this contract on the 26th and started the following day on our return to Birch lake, where we arrived on the 31st, having experienced some delays on account of stray horses. While my party camped there preparing returns of the inspection, I drove to North Battleford to hire some men and to purchase another team and supplies.

We experienced the first heavy fall of snow on November 9 at Birch lake. I procured some sleighs and left for contract No. 24 on the 12th, passing along the west side of the lake, through a good deal of meadow land. We passed a number of hay stacks, where several hundred head of cattle were being held and fed. We arrived at the contract on the 14th, but we experienced considerable trouble proceeding along the trails opened out by the contractor. They were opened out for wagons, and I, having sleighs, was compelled to cut down a great number of stumps nad remove fallen timber; in one instance it took us three hours to go two miles. We commenced inspection of this contract on the 15th and completed it on the 28th. Considerable time was lost on account of my only transit being damaged by a fall, necessitating my borrowing a spare one from Mr. Robinson who was working in contract No. 24. On the 29th we had to break the ice to cross a creek running out of Long lake, and on the following evening was registered the first minus reading on the thermometer.

We arrived at Birch lake on November 30 and having received notice of the arrival of my sleighs from Edmonton and my transit from Agincourt Observatory, where it had been repaired, I sent a couple of teams to Meota on the Jackfish Lake branch of the Canadian Northern railway to get them. The teams returned to camp with the sleighs on December 5 and on the 7th we started off again on the trail for Chitek lake to inspect contract No. 22, where we arrived in section 21, township 54, range 12, west of third meridian on the 9th. From there we travelled up the Green lake trail to the northwest quarter of section 31, township 55, range 11, and after retracing a block there we moved southerly to section 9, township 53, range 12, where we retraced two blocks, completing the inspection of the contract on December 21. We then started on our return trip to Birch lake.

So far as I am aware no cultivation of the soil has been carried on in this part of the country, and I would judge that the open parts would be better adapted for the raising and feeding of cattle, than for the growing of cereals. We found much jackpine and spruce throughout the more northerly part of this contract, but these do not by any means indicate a good farming country.

We returned to Birch lake on December 24 and, leaving my outfit there, I drove to Meota and thence by train to North Battleford in order to purchase some supplies.

I returned to Birch lake on December 28, and left there with my outfit on the 30th for the inspection of contract No. 25 of 1912. We travelled northwesterly over a good deal of meadow land to Midnight lake, crossing to the west side of the lake, on the ice. About half a mile farther west we struck the new provincial Government road to Meadow lake. This road is said to have been greatly improved during last summer, all the soft places having been corduroyed; it makes a good sleigh road now, and possibly may be a fair summer road too.

I reached this contract on January 1, 1913, and on the following morning moved to the northeast quarter of section 2, township 56, range 16, west of the third meridian, and camped on the north side of a lake. From there we retraced two blocks in townships 57 and 58. Like the other townships inspected last fall and winter, muskegs appear to abound; the surface is divided up into muskeg, jackpine ridges and poplar groves of less or greater extent, the first or second of the three predominating in the various townships. The latter indicates the better class of land, the first the richer soil, and the second generally consists of light sandy soil. It is my belief that this section of the country will ultimately become a good cattle country after repeated fires have cleared off the timber

While camped in this district our thermometer for the first time during the winter registered lower than 40° below zero; in fact at my camp it was 44° below and at the contractor's camp about four miles north, 47° below. From this camp I moved across the lake and from there cut a trail south through about four miles of muskeg.

Rabbits were more plentiful in this district than I had ever seen them in my fifty years of survey experience, but they were afflicted with some disease, and were dying off by scores. At one place where we camped about four days, eight dead rabbits were found behind the tent when we removed it. Invariably when I left my tent to go to the cook's tent for a meal, half a dozen of them would be found in it on my return, sometimes one or two of them dead.

On January 12 we started out for the Government road, and on the 13th drove south past Midnight lake to Stony creek, which runs from Midnight lake to Stony lake. On January 18 we started westerly by way of Stony, Turtle and Island lakes for Brightsand lake, over trails that had not been broken and which were therefore rather heavy travelling in the open places. Generally the north and south trails communicating with the railway are well travelled, but the lateral trails in winter are but little travelled and when the snow comes to any depth they are very heavy.

We arrived at the southwest quarter of section 20, township 53, range 20, west of the third meridian, on January 21, and camped on the west shore of Brightsand lake, and on the 24th we left for Redwillow lake in section 17, township 58, range 21, west of the third meridian. There we traversed the lake, which formed a part of contract No. 33 of 1911. On the shores of this lake were domiciled some parties from the vicinity of Saskatchewan river who had driven in their cattle during the summer, cut hay and were wintering them. The hay is mostly slough hay, but the cattle were apparently thriving on it. In the spring these parties intended to drive their cattle south again to their homesteads. North of this we saw no more settlers' outfits but we saw some Indians, some of them living in houses, in the vicinity of which they had been putting up hay for the few horses they own. We travelled north as far as section 4, township 63, range 20, in contract No. 30 of 1912. Up as far as Beaver river we found recent Indian sleigh tracks, but after that we found it much heavier going, the snow becoming deeper. The immediate banks of Beaver river in this vicinity are not nearly so high as those twenty or thirty miles farther west, where they measured 200 feet or more. The banks of the Waterhen, where we crossed on the ice, are low, the river itself being about 5 chains wide, and apparently shallow. Farther down, the river widens out, the immediate banks being only a foot or two above the level of the water, and probably twenty chains in width. On both sides lay what appeared to be strips of meadow making a total width of probably half a mile. The river is shallow, as at various places where we had to cut through two feet of ice to water the horses, the depth of water generally was not more than a couple of feet below the ice. In one or two places we found a small quantity of hay cut by the Indians, also a stable and a few isolated shacks. The country generally appears flat and is timbered with poplar, spruce and tamarack, with dense willow in places. The general appearance strikes one as being that of a country best adapted for cattle raising. We passed various Indian hunting and trapping camps, where they had apparently fish and meat

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Photo by G. H. Blanchet, D.L.S.

Grand Rapids on the Athabaska. Loon River Entering on Right.

Photo by E. Deville, D.T.S.

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in abundance. Moose and deer are very plentiful, the former being observed almost daily, and judging by their tracks in the woods, the Indians would have no difficulty in procuring a good supply of fresh meat.

From contract No. 33 we moved along Waterhen river down to contract No. 29, and then struck south to Beaver river, where we inspected two townships. By this time the snow had fallen to such a depth that we found it somewhat difficult to make satisfactory headway, the trip from the Waterhen down to the Beaver occupying a whole day. I therefore concluded to bring my season's work to a close. Travelling along the Beaver for a few miles we found it flooded, the weight of the snow having brought the water up on top of the ice. I then decided to strike out by the shortest way to the Meadow lake trail. We arrived at the Meadow Lake post on February 18. After purchasing a few necessaries at the Hudson's Bay company's post we started on the trail which was fairly well broken, and arrived at Brightsand lake on the southwest quarter of section 20, township 53, range 20, on the 21st. There I made arrangements with Mr. Ole Thorson to winter my outfit. I arrived in Battleford on March 1 and paid off the men on the 3rd. I reached my home in Toronto on the 8th.

APPENDIX No. 36.

ABSTRACT OF THE REPORT OF J. B. McFARLANE, D.L.S.

SURVEY OF PART OF THE FOURTH MERIDIAN AND OF PART OF THE TWENTY-FOURTH BASE LINE WEST OF THE MERIDIAN.

During the summer of 1911 I had run the fourth meridian as far as the north-east corner of township 105. As this point was too far north for me to attempt to pack the outfit and supplies from Clearwater river, an attempt had to be made to reach it from the north, that is, from Athabaska lake, and to work from a cache to be located on some portion of the lake. With this purpose in view all possible inquiries were made when I was at McMurray in 1911 about the country between the end of the line and the lake. However, little was to be learned except from the Indians, and their answers are nearly always ambiguous.

I left Edmonton on May 3 with my party and outfit, shipping a car to within eight miles of Athabaska Landing. From there the outfit, supplies and oats for feed had to be freighted to Athabaska Landing. I left the latter place with two scows on May 8. My pack horses which had wintered at Ray left Edmonton on May 2 but I had been entirely misinformed about the time taken to reach McMurray by trail and I had to wait considerable time for these horses. On June 3, I placed a cache at the cascades on the Clearwater for work on the twenty-fourth base line and for the trip out. Then returning down the Clearwater I took the outfit and supplies down Athabaska river to Athabaska lake and thence across to Old Fort river and built a cache about three miles up that river. I had learned at Chipewyan that this was the river which ran along the meridian in township 105, so I chose this spot for the cache as it was convenient to all parts of the proposed line. Here there was another wait of a few days for the horses which were taken to the fourth meridian from McMurray by the trail along the twenty-third base, and thence up the meridian trail and down Old Fort river to its mouth. The outfit was packed up this river and work commenced on the meridian on July 2. The horses had travelled over six hundred miles by land and the outfit by land and water about the same distance before any line was run.

The country through which the fourth meridian was produced in 1912 is much more valuable than the land through which it was run the previous year. The elevation is lower and grass is much more plentiful, and much of the land will be available for ranching. River and creek valleys have good grass in them and considerable scattered grass is found among the hills. This was not the case with much of the land to the south where we had to depend on beaver meadows for horse feed.

The country through townships 106, 107, 108 and the south half of 109 is in general much the same, consisting of rolling or undulating sand hills covered with small jackpine and brulé, and dotted with small lakes, some of which have no outlets. A small proportion of the land is stony. The water in the lakes is generally good, and many of the larger ones have sandy shores. The valley of Old Fort river follows the line closely through these townships and it becomes deeper and narrower farther north. It is nothing more than a large creek in township 105, but it is joined by Beaty river, which is of about equal volume, in the middle of township 106, and is then except at some rapids, too deep to wade. The narrow river flats are generally covered with grass and willow. In township 108, Douglas river, a stream 100 feet wide and three feet deep with a rapid current, joins the Old Fort, and the latter, from there down, would be navigable for scows except that the rapids are too numerous and too

long. In this township the river turns west for about ten miles and then north again. There are no tributaries of appreciable size on the west bank of the river, as a range of hills about five miles west of the river seems to form a watershed. These hills extend to the north to Old Fort point. All timber is kept burnt off or stunted by forest fires which appear to burn regularly and systematically. Back from the river and its tributaries the land is more level. In the centre of township 107 a large muskeg crosses the line and stretches away to the east. The muskegs are valuable in that they have kept the accumulation of soil from being destroyed by fire, and when drained they may become fertile lands. The timber on these is stunted and of little value.

From the middle of township 109 north the surface of the country is quite different. Muskegs cover a large proportion of the land. The pack trail which was chosen so as to avoid these is about twice the length of the line. In the north of township 109, a shallow lake, a mile wide by a mile and a half long, lies across the line. It has a muddy sandy bottom and the entire lake is dotted with water lillies and weeds. A creek one hundred feet wide, and with very little current, flows in at the east end. It resembles the lake in bottom, depth and vegetation and, like the lake, has a stretch of muskeg and swamp on both sides. The outlet of the lake, Harrison river, flows through a swampy flat containing another small lake, then enters a rolling stretch of country, where the river has some rapids. North of the shallow lake the line continues in muskeg to section 25, township 110. Some of this muskeg has been burnt over and, in places, thick grass three feet high had grown on the brulé. I believe that these lakes and this muskeg which stretches away to the northeast could be drained and made into a fertile flat containing an area about equal to a whole township. North of this muskeg the line crosses a range of rolling sand hills about two miles wide, then a creek flowing west to Harrison river runs through a narrow meadow across the line. This creek has its rise in innumerable lakes and wide stretches of muskeg to the east. North of this the line crosses an elevation covered with boulders, then about two miles of muskeg, while the pack trail follows rocky ridges, probably a series of moraines, to the northeast. These ridges are cut off by small muskegs in all directions. From the middle of township 111 to the north of township 114 the country is a succesion of stretches of muskeg from a few chains to a mile or more in width held in by ridges of sand or sand and boulders, or occasionally by some low rolling sand hills. Lakes are numerous and are of all sizes up to several miles in length. The longest triangulation during the season was two miles in township 114. The creeks are all small through the above stretch of country and meadows are scarce, but some of the lakes have slough grass in bays and around the shores. A well-beaten Indian trail from Old Fort bay crosses township 112, striking the meridian near the northeast corner of section 25. Thence it goes on easterly among lakes and muskeg, where it soon becomes indistinct. The only marked valley near Athabaska lake is that of a large creek which crosses townships 113 and 114 in a northwesterly direction. Through these townships the valley is about one hundred feet deep and a mile to two miles wide. When this creek enters township 115 it flows west about three miles down a number of rapids in a narrow ravine, crosses the line, then turns north with only a range of sand hills between it and the lake, and recrosses the line at the northeast corner of section 1, township 115. It enters the lake proper about a quarter of a mile east of the line, but recrosses the line again on the three-quarter mile sand beach. On section 1 the creek flats are about twenty to thirty chains wide and a beautiful hay meadow lies along the creek. There are also several smaller meadows up the creek. This stream is about eighty feet wide and two feet deep, with a current about one and one-half miles per hour. The land to the northeast of this creek is fairly level and dry, covered mostly with jackpine. A fire burnt over most of townships 114 and 115 early in the summer of 1912.

A great deal of red sand was seen through this country but there is not enough iron in it to form an ore.

By September 10 the meridian was run to Athabaska lake and we were ready to move back along the meridian to the twenty-fourth base line, but part of the pack train had made a trip down the meridian to township 102 with supplies for the long trip. These arrived back at the lake on the 13th, and on the following Monday we left the camp on the meridian at the lake and travelled south by the sandy beach of the lake, as this was excellent travelling and much shorter than the pack trail up the line. Good feed was found on a small hay meadow at the mouth of Harrison river at Stone point. When we reached the point north of Old Fort bay the horses were sent around the bay and the outfit was taken across the narrow neck of water on a scow.

The most beautiful hay meadow I have ever seen lies on the point just west of the mouth of Old Fort river. The hay stood from three to five feet high and grew thick on the ground. The area would probably be about two square miles and although willow encroach on the southern part, the northern part is very clear. The water in Athabaska lake was much lower than in June, and on the main shores there is a beautiful sand beach a quarter to a half mile wide, broken only by a few narrow stony points. In the Old Fort bay this beach was a muddy sand with poor vegetation.

On September 23, we left the cache on Old Fort river and moved down the river to the fourth meridian reaching the twenty-fourth base line on October 7. A pack trail had to be cut across range 4 so that work was commenced on the base line on the 14th.

Through ranges 5 and 6 the line lies in undulating and rolling country consisting of sandy ridges and hills with muskeg between. A fire overran most of this country early in the summer of 1912 and killed most of the timber on the dry ground and burnt through some of the muskegs. A patch of twelve-inch poplar on section 33, township 92, range 5, and many sixteen-inch spruce scattered along ridges in sections 1, 2 and 3, township 93, range 5, were fire-killed. The creeks in these townships are small, have a good fall and drain in general to the southeast. On November 4 the line reached the middle of range 6, and my assistants and men refused to go any farther west on the base line, consequently I was forced to quit work for the season, although it was not yet possible to travel out on the ice.

Levels were run throughout the season, work commencing from bench-marks established in 1911 and using the elevation then given them. Levels between each two bench-marks were checked by a separate line of levels. The elevation at the northeast corner of section 36 township 105, range 1, west of the fourth meridian, is 1260 feet. This soon drops to the north as the line enters the valley of Old Fort river. Most of the north part of township 106 and practically all of township 107 lies between 1,100 and 1,200 feet. In townships 108, 109, 110 and 111 the elevation varies around 1,100 feet, local depressions going over 50 feet below, but little change in the general elevation. In township 112 the average elevation drops about 50 feet and township 113 is very level, with an average elevation of about 1,025 feet. The south half of township 114 is about 1,000 feet, but the north half gradually drops to below 900. In township 115 the elevation drops to 843 at the first crossing of the large creek, then rises to 871 to drop again to 842 at the second crossing of the creek. The sand bank between this and Athabaska lake rises to 898 feet. The ordinary high-water mark was 848 feet and the water level on September 9 was 840 feet.

On the twenty-fourth base line the elevation gradually drops quite uniformly across range 5 from 2,255 feet at the east to 1,898 at a creek about the middle of section 31. From that point there is a gradual rise for two miles till an elevation of 2,023 feet is reached. The elevation is about 2,000 feet on an average for the last mile and a half of line run.

By December 5, Clearwater river was frozen sufficiently to travel on and we left there on that day by the winter trail to Big River settlement, and reached Edmonton on December 25.

APPENDIX No. 37.

REPORT OF GEO. McMILLAN, D.L.S.

SURVEY OF THE TWENTIETH BASE LINE WEST OF THE FOURTH MERIDIAN.

FINCH, ONT., January 27, 1913.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following general report on my survey of the twentieth base line west of the fourth meridian, during the season of 1912.

I left Ottawa on April 10 and, after outfitting in Edmonton, I hired two teams and left for the work on April 29, my supplies having been forwarded during the winter by Mr. J. N. Wallace, D.L.S. The route followed was by Fort Saskatchewan, Bruderheim, Star, Wostock, Whitford lake, Pakan, and Beaver river to lac LaBiche. Another route that might have been taken thus far was by Athabaska Landing and then eastward to lac LaBiche, but by the latter the roads are said to be bad during the spring season.

On May 11, I reached Spencer's ranch at the east end of lac LaBiche where the wagon road ends; the two freighters were sent back and our own horses were packed from there. From Spencer's we travelled by the pack-trail leading to McMurray as far as Sandy lake in township 74, range 11, and then by a hunter's trail that passed near the cache located last winter by Mr. Wallace. The cache was near the middle of township 76, range 11. From there to the starting point of our work, a distance of about ten miles we cut our own pack-trail and reached our destination on May 24. The weather was cold and there had been no growth; consequently, the horses were beginning to fail for the lack of grass.

On May 27 we began work on the base line by offsetting the northeast corner of range 10, a distance of 3.02 chains to the north, and then producing the line westward from that point.

In range 10 the surface is low and a considerable part of it has been overrun by fires so that much of the timber is fire-killed. The green timber is small and of little value. The first appearance of grass was about June 1 in the valley of May river near the beginning of the range. This was a great treat for the horses as they subsisted for sixteen days on dead grass and leaves. There are some small meadows and blueberry patches in this range.

Townships 75, 76 and 77, ranges 11 and 12, are mostly covered with muskeg, and the natural drainage is not good. These townships are timbered with small spruce, jackpine and tamarack, the soil being almost valueless as a timber producer. Some good grass grows along the lakes and streams, but nowhere else. The surface of township 78, ranges 11 and 12, is higher and timbered with small jackpine poplar and spruce. The soil is light and sandy and not fit for agricultural purposes.

Range 13 is rolling and timbered with spruce, jackpine, poplar, willow and alder, and contains much windfall. The low land is too wet to be utilized and the high land too light and sandy for agricultural purposes. It serves a good purpose, however, in growing timber. Ranges 14, 15, 16 and 17 are well timbered and they contain a large percentage of good agricultural land. Some of the timber is suitable for milling purposes and pulpwood. There is an abundance of blue-joint hay.

House river crosses the line in range 14; it is the largest stream met with during the summer, except Athabaska river. It is about one chain wide, flows very swiftly in places and varies in depth from six inches to two feet. The banks are low and the soil adjacent is loamy and rich, and supports a heavy growth of grass. This locality is suited to farming and stock raising and plenty of hay can be procured, but at present the lying timber will not permit of the operation of farm machinery. It is, however, good grazing land with a permanent supply of good water.

The location survey of the Alberta and Great Western railway, and also the sleigh road used by the railway company in forwarding their supplies, are intersected in section 32, range 15. This sleigh road follows the muskegs and open swamps and is adapted for winter use only.

Athabaska river was crossed in section 31, range 18; it is twenty-seven chains wide and about twelve feet deep in low water, with a valley 104 chains wide and 370 feet deep. Both slopes are densely timbered with second-growth poplar, large black poplar and some fairly large spruce. The soil is a clay loam and from it ooze numerous small streams and springs which seem to be alkaline. The water from those springs was the only impure water met with all season. Athabaska river is navigable for flat-bottom steamers as far down as Pelican rapids, in township 80, or thereabouts. Scows laden with merchandise for the far north and others with settlers' effects were seen floating down almost every day while we were camped on the river.

For a mile west of Athabaska river there is a rim of firm soil but from there on to Pelican mountain, a distance of twelve miles, there is an uninterrupted muskeg. It was the wettest and most troublesome muskeg to cross that we encountered; almost the whole length of it had to be corduroyed or brushed that it might bear the pack horses.

From the end of range 20 to the end of range 26, the base line follows Pelican mountain. The surface is rolling and densely timbered with spruce, jackpine, poplar, balsam and birch of fair size. There is some milling timber and a great deal of smaller size, suitable for pulpwood. The soil is cold and sticky, and not suited for agricultural purposes. There are numerous small streams all flowing to the north and converging before leaving Pelican mountain. In range 26, these streams have valleys about 100 feet in depth but about three miles north when they have left the mountain, the banks flatten out. Townships 75 and 76, ranges 21, 22, 23, 24, 25 and 26 are more suited to raising timber than to farming, although much of the soil is too light and wet to grow anything but scrub.

To the north of Pelican mountain, in ranges 24, 25 and 26, there is a flat of good land suitable for farming when cleared. At present it is timbered with spruce, jackpine and poplar of medium size. This area is well watered, has a good natural drainage and is adjacent to two lakes containing whitefish. The sleigh trail from Athabaska river to Wabiskaw passes through township 78, range 24.

The facilities of transportation into the district crossed by the twentieth base line consist of the two winter roads previously mentioned, and Athabaska river, but none of these can be made use of during the entire year. The soil varies from sand to a clay loam, together with muskeg. There are two blocks already referred to where the soil should grow good crops after draining and clearing, and the remainder will grow timber.

To the east of the Athabaska the surface is rolling and to the west very rolling and hilly except on the muskegs. There are no prairie lands, as the surface is all timbered. There is very little high land scrub, but the muskegs are all scrubby. Sawlogs, ties and pulpwood can be procured on all the high lands. Hay of the blue-joint variety is plentiful in townships 75, 76, 77 and 78, ranges 15, 16, 17 and 18, and in a few other places. There is a permanent supply of water everywhere. There are no large water-powers, but a small amount of power could be developed on House river by the erection of dams.

The indications are that the climate will be suited to the raising of crops, although at present there are some light summer frosts. The rainfall is like that of eastern Ontario. Wood for fuel can be procured anywhere. No coal, lignite, stone quarries or minerals were seen, but oil development is in progress in some places along the Athabaska.

The game comprises moose, deer, black bears, foxes, coyotes, lynx, rabbits, partridges, ducks and geese; whitefish are caught in all the larger lakes.

I have the honour to be, Sir,

Your obedient servant,

GEO. McMILLAN, *D.L.S.*

APPENDIX No. 38.

ABSTRACT OF THE REPORT OF A. L. McNAUGHTON, D.L.S.

SURVEYS IN THE BRAZEAU DISTRICT.

On June 29, 1912, I left Edmonton for Coalspur on the Alberta Coal branch of the Grand Trunk Pacific railway, as this was the nearest point on the railway to my work, and on July 2 pitched camp in section 25, township 48, range 22, west of the fifth meridian, where our first work was located. Subdivision in townships 47 and 48, range 22, and townships 46 and 47, range 23, engaged the party until November 26. On the 27th the traverse of McLeod river was begun and, on the following day, my assistant left with half the party to finish some mounding in the vicinity of the Alberta Coal branch which had been left over from the previous season's work. With the remainder of the party I continued the traverse of McLeod and Beaverdam rivers, which I finished on December 9. On the 16th, the whole party, having completed all unfinished mounding, arrived at the twelfth correction line south of the Pacific Pass mines. On January 15, 1913, having finished our work in this vicinity, we returned to Mile 8 on the Mountain Park branch. From this camp three miles of the twelfth correction line was run, which finished the subdivision of all the country traversed by that branch. On February 1, we left for Edmonton where we arrived a few days later. Here I paid off and disbanded my party, and leaving Edmonton on February 10, arrived in Kelowna on the 12th.

The country covered by my work is reached by the Alberta Coal branch of the Grand Trunk Pacific railway. The Mountain Park branch leaves this line at Coalspur and, following a general southwesterly direction, enters the mountains twenty-four miles from that place, and terminates at the Mountain Park mines, eight miles farther south. Track-laying was begun on this branch on December 10, 1912, and I believe it is now well under way, and the road will perhaps be open for traffic during the summer of 1913. This gives easy access to the district in which most of my season's work is situated. The twelfth correction line south of township 47, range 19, is reached by a pack-trail running south from the Pacific Pass mines which are situated at the terminus of the Alberta Coal branch. There is a good deal of muskeg along this trail, and I believe it is somewhat difficult for loaded horses during the summer months.

The soil along the south boundary of township 47, range 19, is mostly a clay loam, which is very retentive of water. On this account, and because of the cold summer weather, it is of little value for agricultural purposes. The same observations apply to the soil along the northerly part of the Mountain Park branch. As one approaches the mountains the soil becomes more gravelly and the cuttings along the railroad generally alternate between gravel and solid or shale rock. In this district is found some of the best and cleanest gravel I have ever seen.

Foot-hills of varying height cover the whole district, surveyed, but the country in the vicinity of the twelfth correction line across range 19 is level to rolling, with a great deal of muskeg. The northerly part of township 48, range 22, is also rolling country, while southerly and particularly along the valley of McLeod river, the hills are higher and more rugged in appearance. McLeod river and the Mountain Park branch enter the mountains near the twelfth correction line. South of this line our work was somewhat more difficult and even dangerous, as the season was so far advanced that the slopes were covered with snow and ice.

Fire has swept over the greater portion of the district and consequently there is very little timber of commercial value. Along the north side of McLeod river, near the east boundary of township 48, range 23, there is a considerable area of green timber, spruce, jackpine and balsam which would be suitable for railroad ties. Timber of the same general quality was also seen along the twelfth correction line across range 19. I have been informed that fire-killed timber, if not rotted, makes the very best material for mine props, being much superior to green timber for this purpose. No doubt, therefore, use will be found for a small part of the dead timber which covers the country.

Good water is everywhere abundant in this country. Although McLeod river is very rapid, the character of the valley renders the development of water-power difficult. The most promising site for a power plant along this river is in township 47, range 23. Here the river, at one point, enters a canyon between two perpendicular walls of rock about thirty feet in height and about seventy feet apart. With small expense a dam could be constructed here and no doubt will be at some future date. At present the proximity of coal, capable of being cheeply mined, and the absence of any market for power render the project impracticable. One difficulty in the operation of such a plant would be the large quantity of frazil ice in the river during the winter months.

On account of the high elevation frost is liable to occur on a clear night during any month of the year. During my three seasons' experience in this district, I have seen snowstorms in each of the summer months. Rain is very frequent and during the latter half of August and the first half of September, scarcely a day passed without at least a shower. The fall weather, as usual, was very fine and no severe cold was experienced till about January 10, when we had sixty or seventy degrees of frost.

No outcrop of coal was noticed during the season, but several seams were seen in the cuttings along the Mountain Park branch. These were too near the surface to give any fair indication of the quality of the coal beneath. I did not have any opportunity to visit the Mountain Park coal mines, which lay outside my work, but have been informed that the quality of the coal taken out there is superior to that obtained in the foot-hills. Both the Yellowhead and Pacific Pass mines are now regularly shipping coal, and the indications are that this district will experience a steady growth in population and prosperity and will, in time, become one of the largest coal producing areas on the continent.

APPENDIX No. 39.

ABSTRACT OF THE REPORT OF E. A. NEVILLE, D.L.S.

SETTLEMENT SURVEYS ALONG SLAVE RIVER.

I organized my party at Edmonton, and from there proceeded to Athabaska Landing. For the transport of the party and outfit, I purchased a ten-ton scow and two canoes, and arranged to travel down the Athabaska from Athabaska Landing with the Hudson's Bay company's transport outfit. We left there on May 25, 1912, and on the 29th reached Grand Rapids, where we were delayed until June 5 awaiting the portage of the transport across Grand island, then continuing our journey we safely navigated the Brulé rapids. Upon reaching the Boiler rapids I hired a pilot from the Hudson's Bay company, according to arrangements which I had previously made with them. I also did this at the Long and at the Big Cascade rapids. All the remaining rapids were passed unassisted, following in the wake of the company's scows, and I finally reached McMurray on June 7. Owing to the company's transport being unusually large, I was forced to leave it behind and drift down the river. On reaching the mouth of Athabaska river, the heavy wind delayed me for a day, but as it calmed down in the evening, I effected the crossing of Athabaska lake during the night, and arrived at Chipewyan on the morning of June 16, two days ahead of the Hudson's Bay company's transport.

Chipewyan, with its rows of white houses, presented a very pleasing appearance when approached from across the lake. The rocky hills formed a picturesque setting, and the tepees of the Indians on their semi-annual visit added a touch of romance. The scattered tribes visit the settlements during June to receive treaty, and also come in at New Year to join in the holiday festivities.

The population of Chipewyan will average about two hundred, almost all of whom are engaged in hunting, trading and fishing. Scarcely any land is available for agriculture, but a few gardens are found between the rocky hills.

Following the instructions issued to me, I mounded the settlement of Chipewyan, which I completed on June 24, and the following day I departed for Smith Landing. I safely navigated the rapids in Rocher river, and proceeding down Slave river without any further interruptions, I arrived at Smith Landing on the 28th.

I was engaged for seven weeks in making the survey of this settlement, which extends about eight miles along the river. At the time of my visit the population was between two and three hundred, 95 per cent being Indians. The soil in the vicinity is first-class, consisting largely of heavy black clay loam which is ideal for the production of all kinds of farm produce, such as vegetables, hay and grain. The land, moreover, is easily cleared. At the present time nearly all grain used in this country is imported from Edmonton or Athabaska Landing, but this state of affairs bids fair to be speedily remedied, because, from experiments extending over many years, it has been amply proven that even in that northern clime, grain can be successfully produced. If the alacrity shown by the more progressive Indians in settling and clearing the newly surveyed homesteads is to be taken as any criterion, one can safely predict that in a few years, following perhaps better facilities for transportation, these fertile northern lands will form a valuable addition to the granary of the Empire.

The surface of the country at Smith Landing is mostly flat and gently rolling, and is well wooded, the prevailing species of timber being black and white poplar and

spruce, the latter attaining a diameter of about two feet. With the advent of the Government saw-mill, much building is going on, opening up new avenues of employment for the hardy pioneer.

Hay is obtained from the sloughs within the settlement and also from the islands in Slave river, from which it is transported during the winter on the ice. The quality is that of ordinary slough grass, and there is an abundance of it for all ordinary requirements of the settlers.

The water is all fresh and at present is supplied by the primitive method of dipping from Slave river, but good water can easily be obtained by sinking wells to a depth of from fifteen to twenty feet. There are no streams through the settlement, and the land is not liable to be flooded.

Below Smith Landing there are sixteen miles of rapids on Slave river, having a drop of approximately 140 feet in sixteen miles. It could be dammed and much water-power developed.

Upon the completion of my work in this vicinity, teams were hired and my outfit transported across the sixteen-mile portage to Fort Smith, over as good a road as it has ever been my pleasure to travel.

Fort Smith is beautifully situated and is high and dry, being on the level plateau, one hundred and fifty feet above Slave river. The general characteristics of the district resemble those at Smith Landing. The soil is mostly a sandy loam. The Government Experimental Farm, under the able supervision of Mr. A. J. Bell, Dominion Government agent, is leading the way in agricultural pursuits, and the results of the experiments are very satisfactory.

Fort Smith is noted as being the head of continuous navigation for fifteen hundred miles to the Arctic ocean. At present three small steamers ply from this port down the Slave and Mackenzie rivers. I am informed by Mr. Brabant, chief factor of the Hudson's Bay company for Mackenzie district, that the Company is contemplating bringing supplies into this country from the Arctic and up the Mackenzie in the near future, as a cheaper and safer method of transportation than that now employed of using scows down the Athabaska.

A few remarks at this juncture regarding the Salt river country, twelve miles northwesterly from Fort Smith, might be of interest to the Department.

The great natural salt beds of Salt river are well known. I will only mention in passing that pure salt is here as plentiful as sand on the seashore, and the supply used in this country, for all purposes, is obtained from this source. Here also are found the last great prairies, where the noble buffalo reigns supreme, protected from ruthless slaughter by the Canadian Government. But they are bound to be driven before the onward march of the Canadian farmer, for these prairies are already being claimed as the farmer's heritage. The Roman Catholic mission has, as usual, turned the first sod and now has a ranch of nearly one thousand acres, producing cattle, horses, hay and grain. The Government has here also a large Experimental Farm in a flourishing condition.

The summer weather conditions are ideal. The days are warm, the nights are cool, but frosts during June, July and August are rare. For several weeks in June and July there is no darkness, accounting of course, for the rapid plant growth. The winters, I believe, are scarcely more severe than those of the Manitoba prairies, but the season is longer.

The chief industry of the district at the present time is fur-trading. The rival companies, the Hudson's Bay company and the Northern Transportation company have posts at all settlements. Fish and game, consisting of moose, deer, caribou and water-fowl, as well as the ordinary fur-bearing animals, are plentiful.

I was occupied approximately five weeks in making the survey of Fort Smith settlement, which extends about six miles along Slave river; I believe the available surveyed homesteads will be sufficient for several years to come.

On September 25, I left Fort Smith on my return journey, crossed the portage to the landing, and through the kindness of Mr. Bell was permitted the use of the steamer *Rex* to take me up Slave river. On board this tug I left Smith Landing on September 27, and reached the Little rapids on Rocher river on the evening of the 29th. Here it was necessary to leave the steamer as it could not stem the rapids. On the following day, tracking was resorted to, and I arrived at Chipewyan on the same day.

At Chipewyan, supplies which I had cached on my way down, were taken on board, and I left there on October 1, paddling across Athabaska lake and up Athabaska river. With beautiful weather and continuous paddling the party arrived at McKay on October 10. Above this point the river flows too swiftly to paddle against, so I disposed of one canoe, putting all the baggage in the remaining one, and after two days' hard tracking reached McMurray on the 12th.

This is where the most difficult part of the journey commenced. The water was very low as the snowfall in the mountains had been light the year before. It was necessary to lengthen the tracking line to 250 feet, and even then the canoe drawing about ten inches would not float clear of the shoals and rocks. At times this necessitated wading knee-deep in the icy waters, but happily conditions improved when the Crooked rapids were passed and with the usual portage we slowly advanced up the river and arrived at House river, ten miles above the Grand rapids on October 22. Here we met with a twelve-inch fall of snow which made travelling hard and unpleasant, as it was necessary to walk along the shore and track the canoe.

Daily the weather was growing colder and ice began to drift in the river on the 29th, finally stopping the canoe on the 31st, a short distance below Calling river and about fifty miles from Athabaska Landing. At Calling river I was fortunate in obtaining pack-horses, and thence following the Government telephone line I arrived at Athabaska Landing, overland, on November 4th.

APPENDIX No. 40.

ABSTRACT OF THE REPORT OF T. H. PLUNKETT, D.L.S.

Base Line Surveys in Manitoba and Saskatchewan.

SURVEY OF THE THIRTEENTH AND FOURTEENTH BASE LINES IN THE VICINITY OF THE PRINCIPAL MERIDIAN.

I organized my party at Winnipeg, and, on February 14, 1912, the party and equipment arrived at Chemong siding on the Pas branch of the Canadian Northern railway, ready to commence the survey of the thirteenth base through ranges 32, 31, 30, 29 and 28, west of the principal meridian. A few days were spent in reaching the starting point of this base, and actual survey operations commenced on February 17.

The country traversed by this line was mainly of a swampy nature, the surface being almost entirely covered with moss, varying in depth from three inches to two feet. Numerous floating bogs were crossed, but, generally speaking, there is a solid bottom of gravelly clay or of sandy loam lying about eighteen or twenty inches below the moss. Between the moss and clay lies a layer of black muck. The floating bogs are a semi-liquid mass of decaying vegetation, extending, as a rule, in a northwesterly and southeasterly direction, and are sometimes of a considerable depth, rendering travel over this country in summer almost impossible. Notwithstanding the fact that the country has ample slopes for drainage to the water-courses, it remains inundated over large areas after the snow has disappeared in the spring. This is caused by the carpet of moss, which prevents the water from reaching the outlets provided by the rivers.

During the course of the survey a few very narrow ridges were crossed, but these are inaccessible owing to the interlying swamps and bogs, and, even aside from this, they offer, in their present condition, meagre encouragement to the settler.

There is in this country a drainage proposition which, in my opinion, cannot be solved by individual settlers, but should be undertaken with a view to draining the whole country, following a well-devised plan. To allow homesteaders to attempt to convert this into farming land from its present condition is almost sure to result in failure, and hence would be a set-back to the development of what could be made, I think, a fair farming country. Notwithstanding the fact that public attention has been so forcibly directed during the past three years to this portion of the Canadian west on account of the railroad construction, past and present, no attempt at agriculture has been made, to my knowledge, along the already operating Pas branch of the Canadian Northern railway. This fact seems to prove conclusively that something must be done towards improving the drainage before settlers will attempt to work the land.

This is, of course, a bush country, the prevailing varieties of trees being spruce and tamarack. These are of no commercial value, and are, as a rule, small. South of the base line in ranges 28 and 29, spruce suitable for ties was found, but not in large quantities.

Overflowing river, a stream about eighty feet wide, was crossed in section 31, range 29. It flows northeasterly, with a current of two to three miles per hour. The banks are low and the country for a half-mile on either side shows evidences of flooding. No available water-powers were seen.

This base line was completed to the easterly limit of range 28 on March 15, and the outfit was then moved back to the second meridian, where work was commenced at once on the same base line west of the meridian and continued to the easterly limit

of range 2. The line in range 2 began the ascent of the Pasquia hills, and, as my party was to remain in the field continuously throughout the spring and summer, it was deemed wise to abandon the survey of this base at present and to return to it when the spring break-up rendered work impossible at lower elevations.

Accordingly, a move was made to Whitehorn siding, by train, and from there by dog teams to the point of commencement of the fourteenth base line on the second meridian, a distance of about twenty miles.

Work was commenced on this base on April 1, but no sooner had we begun, than the spring break-up commenced. By April 5 the snow was practically gone, and we found ourselves surrounded by a country flooded to a depth of from one to two feet. Wading through this ice cold water soon had its effect on the personnel of my party. There arose an irresistible desire amongst the labourers to seek more congenial employment. Every remaining member of the party became an axeman, and both line and outfit reached better footing in range 28, on April 18.

From the commencement of the base in range 31 to the western limit of range 28, the country showed every evidence of being flooded, in the spring at least, this notwithstanding the fact that six water-courses were crossed in this distance. In section 33, range 31, a river forty feet wide, with banks four feet high, flows north into Waskwei river, which, in turn, was crossed in section 31, range 30. Waskwei river at this point has a width of sixty-six feet, with banks six feet high, and flows north to join Carrot river. In addition to these rivers, creeks fifteen feet wide were crossed in sections 33 and 34, range 31. Pasquia river flows through section 35, range 30. This river is about one hundred feet wide, with banks five feet high. It flows north into the Saskatchewan at Pas. We found these rivers frozen almost to the bottom and were unable to determine their currents. These, of necessity, must be slow. At high water on the Saskatchewan, Pasquia river provides a channel for conducting the surplus Saskatchewan water over the country. From this peculiarity Pas receives its name, Pas being a shortened Cree expression for a river that flows in two directions. In section 33, range 29, a stream one chain wide was crossed. This has no well-defined banks, and meanders northerly through an extensive floating muskeg to join Pasquia river.

Ranges 31, 30 and 29 are, at present, utterly unsuited for agriculture, and the country presents serious drainage difficulties. Although we did not have an opportunity to observe the rivers at high water, there are numerous evidences that they are insufficient for the country's drainage.

In range 28 the country became more rolling, with fewer disadvantages to settlement, though it, too, is far from desirable agricultural land. On all sides deep moss covers the ground, but under this there is a depth in places of over two feet of black loam; other parts were clay, carrying limestone boulders. This range has been burnt over along the Canadian Northern railway.

The line passed through a country continuously wooded. In range 31, there is a large area of tamarack swamp. In sections 31 and 32, tamarack and spruce range from six to eighteen inches in diameter, but the tamarack is nearly all dead. Throughout range 31, considerable areas of this swamp were encountered in every section. These patches of timber alternate with low wet places, generally covered with dense willow brush. In ranges 30 and 29, the heavy timber disappears and gives place to a dense growth of small spruce and tamarack on the comparatively dry ground, while on the bogs there is a scattered growth of stunted trees of the same varieties. Throughout range 28 the country is wooded with a dense growth of small spruce, suitable only for cordwood. In range 27 the land appears to drop again.

Having reached the easterly limit of range 28 on April 23, it was decided to return to Chemong and continue the thirteenth base west of the second meridian. Dogs, which had been our means of transport during the winter, were now dispensed with and pack horses substituted for work on the Pasquia hills, where we were sure of solid ground.

Work there was commenced on April 26. In range 2 we reached the base of the Pasquia hills. Regarding the land in ranges 1 and 2, there is no good reason why this should not be, in the future, a good farming country. At present, however, these ranges are covered with excellent merchantable timber, consisting of spruce and tamarack, and lumbering operations are now flourishing. There is a saw-mill in operation one mile south of Chemong siding, and lumbering is in progress all along the railway from Hudson Bay Junction to mileage 40.

In ranges 3 and 4, the line crossed the Pasquia hills. The summit of these hills is 1,348 feet above the level of the Canadian Northern railway track at Chemong siding. These hills are cut up by deep ravines, through which flow streams of good water. The land is mostly too rough for farming, and no attempt to cultivate it will likely be made for some time. An excellent view of the surrounding country is to be had from the summit of the hills. The side slopes are wooded with spruce, birch and poplar, with usually a dense undergrowth of brush. The summit is covered with brulé and considerable swamp, with patches of dense small spruce and tamarack of no commercial value.

The following remarks regarding game, minerals and climate will apply to all the country mentioned above. Game, including moose, caribou and deer, is very plentiful; east of the second meridian caribou are especially numerous. The moose appear to live in the Pasquia hills in summer, and are not often seen on the lower land until the snow in winter drives them out of the hills. Mink were seen on the Overflowing, Waskwei and Pasquia rivers, and traces of lynx were in evidence, though they are not plentiful. Muskrats do not appear to flourish here. Bears are very numerous in the Pasquia hills, and rabbits and grouse abound. Timber wolves are fairly plentiful.

A salt spring, the water of which was decidedly saline, was found flowing freely in March in range 28 on the thirteenth base east of the second meridian. Salt springs, I am told, are of common occurrence in this country, but, with the exception of these, no traces of minerals were found.

Except for a large meadow south of the thirteenth base line in range 2, west of the second meridian, there is little likelihood that horse feed of anything approaching first-class quality is to be found. No meadows were seen on the Pasquia hills, and the country as a whole seems particularly devoid of grasses.

The winter of 1912 was considered a severe one throughout the West. During February our thermometer registered as low as 38 below zero, and snow to a depth of two or two and a half feet covered the ground, but the snowfall in February and March was very light. Bright, cold days succeeded one another until April 1, when there was a decided rise in temperature and spring commenced at once. Although living in tents we did not feel the cold severe, and no time was lost to the survey work during February and March on account of stormy or excessively cold weather. Night frosts continued throughout April and May, and the last frost noticed occurred on the night of June 5. A severe snow-storm commenced on April 27, and snow to a depth of eight inches fell in range 2 on the thirteenth base west of the second meridian. The temperature then began to rise and rain continued every day until May 7. The country was flooded on all sides, and severe washouts occurred on the railway. There was no sign of spring growth on the Pasquia hills until May 28, but when work in this locality was brought to a close on June 14, the weather was decidedly hot.

SURVEY OF THE TENTH BASE LINE WEST OF THE PRINCIPAL MERIDIAN.

The party moved to Winnipegosis on June 15, 1912, and after a short delay, owing to a storm on the lake, we sailed from there across lake Winnipegosis, and up Waterhen river to Waterhen lake.

The boats were first taken north on Waterhen lake, to where it was expected that the tenth base would strike the lake shore. Our provisions were unloaded there and five men were left with instructions to move supplies east as far as possible, as soon as the pack horses which had been sent overland around the lakes arrived.

With the remainder of the party and sufficient supplies, we then sailed south to the intersection of the ninth base line with the more easterly of the two Waterhen rivers. These rivers, one of which flows north from lake Winnipegosis to Waterhen lake and the other south from Waterhen lake to lake Manitoba, are almost parallel, and only a few miles apart.

Our horses arrived on June 21, and twelve were sent north at once to move our provisions east, while twelve were retained for transport along the block outline leading up to the tenth base. Work was commenced on June 22 and continued without serious delay until the base line was completed on November 5.

We found on starting our work that Mr. P. E. Palmer, D.L.S., had, as part of his contract, already surveyed the eastern boundary of township 33, range 15. This work was retraced according to instructions and new surveys commenced at the northeast corner of section 36, township 33, range 15, west of the principal meridian. The work then proceeded without delay until the northeast corner of township 36, range 15, was reached on July 5.

There, I was disappointed to find that efforts to move our provisions east, along the supposed course of the tenth base had not been successful. Floating bogs on which it was impossible to take the horses seemed to stretch in all directions.

As long as our work had led us in a northerly direction, the bogs, which are characteristic of this whole country, had not hindered our progress, because running, as they did, almost due north and south, good trails could be found on open ground along their edges. When our work turned east and west, however, it was quite a different proposition to transport supplies. Merely extending the survey was a comparatively easy task.

Before setting to work to cross these bogs with our supplies, I decided to make an exploration easterly to find what likelihood there was of being able to go forward with the base, provided the bogs we were in could be crossed. With Mr. C. J. Harper, one of my assistants, I travelled about fifteen miles east, and found the country steadily improving from a transportation standpoint.

The only good farming land seen during the summer is situated at the commencement of our work. Portions of townships 33, 34, 35 and 36, range 15, offer a few splendid locations for settlers. The more easterly of the Waterhen rivers seems to drain this range fairly well and offers an excellent means of drainage for the parts still wet. The wild grasses in this locality were of nutritious quality, and the soil generally placed this range in a class by itself from an agricultural standpoint. East of the easterly limits of range 15, in the townships mentioned above, floating bogs occupied large areas and for the more southerly of these I am doubtful if there are drainage facilities to lake Manitoba.

The country along the tenth base line as far east as range 10, is a regular succession of floating bogs, in which there was considerable open water and ridges.

The ridges in range 14 are generally suited to agriculture, but in summer they are practically inaccessible. The soil on these ridges is of fair quality, but after this range is passed the ridges are very stony. Our levels show a decided western slope to the land and the bogs no doubt could be drained. It has been the experience of farmers, who have drained similar bogs, that they make excellent farming land. The depth of these varies greatly; in some of them midway between the bordering ridges I found a solid clay, carrying boulders at four feet deep, while in others a pole sixteen feet long could be pushed down easily and at this depth no bottom was reached. The notes of our survey give no idea of the area occupied by these bogs, as they lie almost north and south. I would roughly estimate that they constitute from 60 to 75 per cent of the whole country.

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Photo by J. R. Akins, D.L.S.

Camp in Tp. 96, R. 17, west of the Fifth Meridian.

Photo by J. S. Galletly, D.L.S.

Pack Trail in Tp. 109, R. 15, west of the Fifth Meridian.

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The ridges in range 14 were wooded with merchantable spruce, poplar and birch. In ranges 13, 12, 11 and 10 the predominating timber is jackpine, spruce and tamarack of no commercial value. I did not see even tie timber from range 13 to Warpath river in range 7. After range 10 was passed the jackpine entirely disappeared, so also did the ridges, and the country became almost impassable.

In ranges 9, 8, 7 and 6 moss covers the ground to a depth ranging from two to four feet. The bogs, unlike those in the previous ranges which are generally open, are wooded with stunted tamarack.

On all sides small lakes were seen, and a slight pressure on the moss will show water at the surface. It was very difficult to find sufficient solid ground in range 8 on which to camp. The whole range, as well as ranges 9 and 7, had to be corduroyed in order to get our horses to the banks of Warpath river, in range 7. Ranges 9 and 8 are wooded with spruce and tamarack only, and these too small to be of value.

On reaching Warpath river on September 17, our horses were turned loose to feed along the banks. This grass was the only horse feed of anything like good quality we had been able to get since leaving range 14. After feeding on this grass for three weeks three horses died, and little improvement could be noticed in the condition of our remaining horses on November 4 when we came out.

Throughout ranges 7, 6 and 5 man-packing was resorted to, and the line carried through to lake Winnipeg.

Between the river in range 7 and lake Winnipeg there lies a large tamarack swamp, streaked with floating bog. The tamarack are large, and would be suitable for ties.

After the completion of the base to lake Winnipeg, a return was made to Warpath river, where my cook outfit had been stationed while supplying provisions for the work in the last two ranges. It was decided to take advantage of the means of transportation afforded by this river to run the block outlines between the ninth and tenth bases. The camp outfit was moved in boats up the river and camps established on the bank. This necessitated rather long walks to the work sometimes but the condition of our horses rendered their further use impossible.

The survey of the easterly outlines of townships 36 and 35, in range 8, disclosed no better land for farming. Swamp, bog and moss were continuous, and the spruce and tamarack back from the river bank still continued small and of no commercial value.

At the ninth correction line the bulk of the camp was left and man-packing again used to run the east outline of township 34, range 8, north. This six miles followed a dry, jackpine ridge, the trees ranging from six to eighteen inches in diameter and growing thickly. About two miles west of this line we found about two square miles of excellent spruce and tamarack. This lies approximately in sections 10, 11, 14 and 15 of township 34, range 8. The soil on the ridge is light and sandy, but west of that, in the spruce, it is good.

One of the striking features of this whole country is the absence of creeks and rivers. Not until we reached Warpath river, in range 7, did we cross a river or even a creek, but on one or two bogs I noticed that water was flowing quite rapidly through the grass over the whole surface of the bog. Often, on going a second time over our horse trails in the moss, we found the water flowing freely down the trail. When Warpath river was reached, we were surprised to find that although this river, sixty feet wide, flowed with a current of from three to three and one-half miles per hour, it did not seem to have any drainage effects on the country through which it passes, the bogs extending almost to the river. No doubt the depth of moss prevents the water from gaining an outlet.

We had an opportunity, during the summer, to see the enemy of the tamarack trees hard at work. Thousands of these short green worms were to be found feeding on the needles of the tamarack and they entirely stripped the trees of their foliage.

One could not walk among these trees without being covered with the little grubs. No tamarack, however isolated, seemed to be escaping this scourge, and what is more peculiar still, no other variety of tree was affected.

Regarding game, I may say moose and caribou are very plentiful, these animals being seen almost daily. Traces of lynx were fairly plentiful, and mink, otter and muskrat were numerous on Warpath river, but only a few traces of bears were seen. Rabbits and grouse are particularly plentiful. Jackfish were abundant in Warpath river.

During the latter part of June and the first part of July, the heat was intense and no summer frosts were noticed. The lakes were open until November 5. The first frost occurred on September 14 and 15, when thin ice formed on the standing water in the swamps.

Notwithstanding the large gypsum deposits north of the ninth base, no trace of this or any other material was seen on our work.

On November 5 we commenced our journey to Gypsumville. It had been thought that we could take our outfit up Warpath river to Gypsum lake and thence to Gypsumville, as maps of this country show the river flowing out of Gypsum lake. The main Warpath river does not, however, rise in Gypsum lake, but in Pine lake, some distance west and north of Gypsum lake. Moreover, there is no continuous waterway from Gypsum lake to Warpath river, and we were forced to take our camp across the portage, which is a large floating bog, to Dauphin river and up the Dauphin to lake St. Martin. This lake we found frozen over at the source of the Dauphin and we had to man-pack our belongings to where a yoke of oxen could reach them and take them to Lake St. Martin Indian reserve. The country was in a very wet condition after the unusually wet summer and it was November 18 before the camp equipments reached Gypsumville.

SURVEY OF THE ELEVENTH AND TWELFTH BASE LINES WEST OF THE PRINCIPAL MERIDIAN.

We left Chemong on December 16, 1912, for Fishtown siding, near Novra station on the Canadian Northern railway. A few days were required to open up the old sleigh road, which leads easterly from Fishtown to the Swan Lake Indian reserve. Supplies and equipment were soon placed in range 24 and survey work commenced at the quarter post on the north boundary of section 36, township 40, range 25, west of the principal meridian, on December 28.

In range 24, some very good farming land was crossed. This land is wooded fairly heavily in section 31 and 32. Wood river, a stream 100 feet wide, with well defind banks and flowing north through the Swan Lake Indian reserve to Swan lake, was crossed in section 32. Section 33 and fractional section 34 are low-lying meadow land. The Indians on Swan Lake reserve report that previous to the summer of 1912, they were able to cut hay on all this land but during this exceptionally wet season they were unable to harvest hay excepting on land near Swan lake.

In section 34, Swan lake was reached. This lake is very shallow, and freezes almost to the bottom. Fishing is carried on by the Indians on Swan river, the mouth of which was crossed in section 31, range 23. No fishing appears to be done on the lake, and only jackfish and pickerel are caught in the river no whitefish being found there.

Having crossed the lake we saw some excellent farming land in sections 31, 32, 33 and 34 in range 22. This belt of good land extends along almost the entire easterly shore of Swan lake. This country, of course, is heavily wooded but the soil is of excellent quality and in section 32 the land lies fifty feet above Swan lake. In section 35 the land drops considerably and a large area of swampy country covered with deep moss and wooded for the most part with scrub, spruce and tamarack, extends far north and south of the base. The description of the base line through section 36, range 22, and sections 31, 32, 33 and 34 of range 21, cannot be taken as a fair indication of the nature of the country in general. The line there approaches Pelican lake, and running for some distance through country immediately south of the lake, passes through land heavily timbered with excellent spruce, poplar, birch and tamarack, and presents some good locations for settlers. Large meadows extend south from Pelican lake

through sections 33 and 34, range 21. There is, I think, no doubt that a considerable portion of these could be cropped.

Creeks were crossed in sections 32 and 33, range 21, flowing north to Pelican lake, but the water in these was decidedly saline.

My ranger reported that north and south of the base in range 21, the country from an agricultural standpoint is far inferior to that described in the field notes of the survey. North of the base, small spruce and tamarack are found in all directions, with an almost continuous scattering of small jackpine. Open grassy stretches were occasionally met, which, from his description, I expect were floating bogs. South of the base the country was more promising, larger areas of spruce and poplar being found.

In section 34 the west shore of Pelican lake was reached. This lake is a much larger body of water than the maps of this district indicate. It measured over five miles in width, where the base crossed it and extends southeast to within two miles of lake Winnipegosis. It appears to be as large as Swan lake.

The country between Pelican lake, in range 20, and lake Winnipegosis, in range 18, is, for the most part, swampy, though apparently not nearly so wet as the country along the Pas branch of the Canadian Northern railway. In range 19, the land becomes more rolling and poplar ridges were crossed in section 35. I think this country might be developed into fair agricultural land. Lying under the moss and muck is a sandy clay, carrying limestone boulders. This limestone lies within eight inches of the surface in section 36, township 40, range 19.

The country is principally covered with spruce, tamarack and occasional jackpine. Brulé covers the surface in range 19. A considerable spruce forest once flourished in this range, but fire has completely destroyed it.

With range 18, the country again becomes a swamp, wooded as before with scrub spruce and tamarack, until the usual narrow strip of high land bordering lake Winnipegosis is reached in section 32.

With the exception of Birch island, no more land was crossed on this base. This island, lying in sections 35 and 36 of range 18, and sections 31, 32 and 33 of range 17, contains a limited amount of good agricultural land. It is wooded with small poplar, birch, spruce and tamarack and for some distance in the centre of the island, the land becomes swampy, but this could be easily drained.

Having crossed lake Winnipegosis, the base was carried to the northeast corner of section 36 in range 16. East of lake Winnipegosis, the land along the base was very swampy, small lakes being numerous. High land is found south at a distance of about five miles but north the usual swamp, characteristic of this country, stretches far and wide.

By February 21, 1913, the work was completed on the eleventh base and the party started at once for the twelfth base line in township 44, range 25, west of the principal meridian.

The return was made along our own trail on the eleventh base, as far as Swan lake in range 23. The party was then taken north on Swan lake and Shoal river to the Armstrong Trading Company's post on Dawson bay. There advantage was taken of the winter road between Pelican Rapids post-office and Mafeking as far as Steeprock stopping place where we found ourselves, on March 3, only a few miles south of our point of commencement on the twelfth base line.

Acting on your instructions, a retracement survey was made on the north boundary of township 44, range 25, and new surveys commenced on the twelfth base in range 24, on March 10.

Throughout ranges 25 and 24 our surveys traversed a rolling country which, as we approached the shore of Dawson bay in section 31, range 24, was fairly heavily wooded. In the valleys the country is generally of a swampy nature, but, with proper drainage, it could no doubt be utilized for agriculture. The higher land is wooded with spruce, tamarack, poplar, birch and balsam. Generally speaking, the timber is

as yet too small to be of value for lumber, but some trees close to the lake, in range 24, measured as large as twenty-four inches in diameter. The soil in range 24 consists of clay, carrying limestone boulders, and outcrops of limestone rock are frequent all along the lake shore.

The easterly shore of Dawson bay was reached in section 32, range 22, the base having crossed narrow points in sections 35 and 36 of range 23, and section 31 of range 22. These points form part of Indian reserve No. 65 B.

Surrounding Dawson bay south of the base in ranges 24 and 23 there is a strip of land from one to two miles in width, wooded very heavily in places with spruce, tamarack, birch and poplar up to twenty-four inches in diameter. This, when cleared, would afford some excellent locations for settlers. In fact, from our explorations through the whole country adjacent to the eleventh and twelfth base lines, it may be fairly well described by saying that contiguous to the lakes there is always to be found a belt of high land which when cleared would make good farming land. Back from the lakes, one, two or at most three miles, the country either remains a mossy swamp or, what is worse, a floating mass of decaying vegetation.

In ranges 22 and 21, the base crossed the point of land separating Dawson and Pelican bays. Here again we found, on either side of the point, fairly high gently-rolling land, well wooded with spruce, birch, poplar and tamarack and adapted for agriculture, while the intermediate land still remains a mossy swamp wooded with stunted spruce and tamarack.

The only other land touched by the base, as far as we surveyed it, lies on the narrow point separating Pelican bay from the main Winnipegosis lake. This land lies in sections 33, 34, 35 and 36 of range 20, and sections 31 and 32 of range 19.

Owing to the narrowness of this point, practically all the country traversed by the base line and north of it is fit for agriculture, but south, where the point is wider, the muskeg is found, as usual.

The soil on the high ground consists of clay loam with limestone gravel or boulders. The swamp land is covered with moss, under which lies a layer of about one to two feet of black muck. The subsoil is clay carrying limestone boulders. Outcrops of stratified limestone are frequent on the lake shore and on points running into the lake.

The survey of this base was completed to the northeast corner of section 33 in range 16, on April 3, and the return journey to Mafeking station was commenced at once. We returned by our own trail along the base line as far as Whiskey Jack point. There we reached the winter road which leads to Mafeking via Pelican Rapids post-office. The party reached the railway on April 8.

During the winter of 1912 and 1913, some intensely cold weather was experienced, especially from January 4 to February 14, the thermometer registering as low as 60 below zero on January 19, 20 and 21. Seldom during this period did the temperature rise above 20 below zero. With the exception of this cold spell, however, the weather was very favourable for survey work. In fact only three days were lost during the entire winter owing to the excessive cold. The snowfall was not heavy, there being at no time more than two feet of snow on the level. Snowshoes were seldom used. The fall of 1912 was exceptionally fine, no cold weather being experienced until late in December. By April 8 the snow had almost entirely disappeared, and spring opened at once.

Winter fishing was carried on by the Indians and white settlers on lake Winnipegosis during the entire winter. Whitefish, pickerel and jackfish are caught there in large numbers. Fishing and trapping afford ample winter work for settlers in this locality.

Game, including moose and deer, is very plentiful. The moose live in the Porcupine mountain in summer. In winter they are to be seen daily throughout the country traversed by the eleventh and twelfth base lines. Rabbits and grouse are

numerous and during the past winter many bevies of the white grouse or ptarmigan were seen. Muskrats, mink, lynx and otter are also fairly plentiful throughout this country. Timber wolves are rarely seen now, but large numbers of brush wolves are still to be found on the lakes in winter feeding on the piles of fish offal left by the fishermen. These animals are said by trappers to be slightly larger than the prairie wolves, but they do not travel in packs and appear very cowardly.

On the completion of this work the party was paid off at Mafeking on April 10.

APPENDIX No. 41.

ABSTRACT OF THE REPORT OF R. C. PURSER, D.L.S.

MISCELLANEOUS SURVEYS IN SOUTHERN SASKATCHEWAN AND ALBERTA.

The work on which I was engaged during the season of 1912 consisted of small scattered surveys in the provinces of Saskatchewan and Alberta.

My first important survey was the extension of section lines on the dry bed of Goose lake in township 32, range 10, west of the third meridian. This work was commenced by Mr. W. A. Scott, D.L.S., in December, 1911, but cold weather prevented its completion at that time. The banks of this lake are from five to twenty feet high and the bottom is a great and almost level stretch of clay soil. With the breaking up of the surrounding prairie, the water has all disappeared, leaving a perfectly dry expanse that is gradually becoming covered with vegetation which is growing out from the old banks towards the centre. No doubt in time the whole flat will be one large stretch of prairie, hay and farming land.

In township 39, range 1, west of the third meridian, two sets of duplicate monuments along the south boundary were noted. No information could be obtained from the residents as to which were the correct monuments and no explanation could be made as to the cause of their existence. Fourteen miles of line were retraced in an endeavour to determine the correct line. All appeared to be in the same state of preservation and no pair of monuments corresponded with the measurements given on the plan. The correction of these duplicate monuments thus resolved itself into the selection of those monuments which would give the most equitable portion to all the quarter sections involved. These were selected and renewed and the others were destroyed.

In township 39, range 13, west of the third meridian, the monuments had been reported lost, and an examination was made to determine if the survey was necessary. It was found that a resurvey was urgently required. This district is reached by good trails from either Maymont or Radisson on the Canadian Northern railway and then by a ferry across Saskatchewan river. The township, being in the midst of the Eagle hills, is rather rough and is, for the most part, covered with a heavy growth of poplar and balm of Gilead. A luxuriant growth of pea-vine and wild flowers cover the best portions to a height of three or four feet. A large number of the original monuments in this township could not be found, and this fact has seriously hindered the taking up of the land by homesteaders. An attempt had been made by some of them to lay off their quarter sections by compass lines. The few settlers at present in this township are obtaining good crops. Scarcely any trails except winter roads lead into the dense growth in the central portion of the township. To drive farther west one must make a detour either to the north or south over circuitous trails.

A traverse of part of the east bank of South Saskatchewan river in township 33, range 6, west of the third meridian, proved very arduous work for a travelling party of two persons. Commencing at the intersection of the north boundary of section 24 with the river bank, I traversed the shore northward to the north boundary of the township. This was necessarily through thick bluffs of poplar and alder along the top of the river bank, it being impossible to use the beach on account of its narrow and winding nature. Formerly the main body of the river flowed along the west shore, but recently changes have occured and now the current runs swiftly along the east bank where it has already, by a gradual erosion of the sandy soil, worn away several acres from some quarter sections. Two islands were surveyed; the larger one, con-

taining roughly about three hundred and fifty acres in township 33, range 6, west of the third meridian, has virtually become part of the mainland due, probably, to changes in the river level since the original survey. A channel less than one chain wide separated the island from the river bank. At present this old channel still exists but it requires a rise of four feet from the average level of the river to send any water through it. This island is of little value for agricultural purposes at present as the soil is light and the surface is thickly wooded. Evidences are also present showing that within recent years the whole island has been inundated by the waters of the river.

In township 49, range 6, west of the third meridian, several lakes were traversed which had been missed by the original subdivider; one of these was about four hundred and twenty acres in extent and was reported to be over one hundred feet in depth.

Many other small surveys besides those above noted were made.

The progress of the season's work was hampered somewhat by the very wet weather that prevailed during the summer months.

APPENDIX No. 42.

ABSTRACT OF THE REPORT OF C. RINFRET, D.L.S.

MISCELLANEOUS RESURVEYS IN SOUTHERN SASKATCHEWAN.

I organized my party at Moosejaw and, on June 5, 1912, left for my first work which consisted of investigating duplicate monuments in five townships southeast of Moosejaw. A second subdivision of these townships were made in 1883 and the then existing monuments were not all destroyed. All the land in these townships was taken up long ago, and most of it is now under cultivation.

The next work, which was reached on June 29, consisted in surveying the dried-up portion of the bed of Johnston lake, southwest of Moosejaw This portion is an alkaline flat yielding abundant hay of second-class quality, and covers an area of about six square miles. Township 14, range 29, on the north side of the lake has sandy loam soil, and although very rolling in the north it is rapidly being taken up by homesteaders. The north third seems best adapted for ranching.

Having completed this work, we proceeded by trail to some townships northeast of Maple Creek which were to be resurveyed, arriving there on August 22.

Townships 14, ranges 23 and 24, west of the third meridian, consist for the most part of sand hills covered with shrub and are at best only suitable for ranching, hay being found in places and good water being easily obtained.

A strip of good loam soil, fairly level and about four miles wide covers the northern part of townships 15, ranges 23 and 24, beginning near Bigstick lake and stretching eastward, but the south third consists of sand hills and is useless. In township 15, range 23, oats and wheat grow splendidly, and the township is being well settled. Most of township 15, range 24, is leased to ranchers, although there are a few good homesteads still available.

In this district the settlers complain of the lack of herd law, as cattle and horses are allowed to roam at will, damaging the crops of those who have not the means of fencing up their land.

The north third of township 13, range 25 has a good soil but it is very rolling and would be best suited for ranching.

The whole of township 15, range 26, has good soil and is fairly level. It is now all taken up and partly cultivated by numerous German settlers. Two years ago not a shack could be seen for miles around.

Having completed the survey of this township I disbanded my party on October 18, after which, with my assistant, I proceeded to make a few miscellaneous surveys.

I corrected wrongly-placed monuments in townships 14, ranges 1 and 10, and also in township 32 range 26, all west of the third meridian. This necessitated driving, and travelling by rail.

My next work was to survey those parts of the townships bordering the Quill lakes which had dried up since the original subdivision. These lakes had not dried up to any noticeable extent except in townships 32, ranges 17 and 18, and township 33, range 18, west of the third meridian, where a few square miles required subdivision. I also surveyed a few lines in township 34, range 16.

The land recently dried up consists mostly of an alkaline flat, swampy in places, and not much good for farming. It yields plenty of fairly good hay, but only one crop every other year.

Some changes were also found in township 34, range 14, and township 35, range 17. In the latter township the lake is larger than on the original plan, but as there were no farmers living in that vicinity we were unable to get board, and the survey could not be conveniently done at that time. Therefore, after completing the inspection of all the other townships bordering the lakes, I closed operations for the season on December 12.

APPENDIX No. 43.

ABSTRACT OF THE REPORT OF A. SAINT CYR, D.L.S.

SURVEY OF PART OF THE EIGHTEENTH BASE LINE WEST OF THE THIRD MERIDIAN.

On February 21, 1912, with four loaded teams of my own and four others hired from Mr. W. C. McKay, we left Big River, where my supplies and outfit had been shipped by rail, for Doré lake. On this trip we took the new Isle à la Crosse winter road and, after crossing the portage between the south end of Cowan lake and lac DeLaronde, we travelled the whole length of the last-mentioned lake. We then crossed another portage to Sled lake, where there is a small settlement near its north shore. Here travellers are always pretty sure to find lodgings and also feed and stabling for their horses at the home of an enterprising fur trader who took up land ten years ago and has since cultivated part of it, raising oats, barley and vegetables.

Good hay in quantities can also be procured from meadows not very far distant from the settlement, and this should be an inducement to any rancher looking for a suitable location.

From Sled lake, the winter road runs through a flat and sparsely wooded country which extends to a deep but narrow bay at the south shore of Doré lake; this bay opens out in the lake five miles north of the place where the overland route ends, and at the north extremity of the high headland which closes this bay to the west, is now located one of the company's fishing stations, which we reached on the night of February 24.

On February 28, we arrived at a point on the northeasterly shore of Doré lake where it was decided to build a cache. The hired freighters left us here and returned to the fishing station.

I discovered an old road leading to lac La Plonge, and while my men were at work building the cache I blazed this road anew for several miles, so that the packers would have no trouble following it when going to the cache for supplies later on. A rough compass survey of the west half of Doré lake was also made from this camp.

On March 4, I joined my men who had finished the cache and the next day we began our return journey, arriving at Big River four days later. On March 9, I sent my teams by the overland route to Montreal lake, while I returned by train to Prince Albert.

The following days I spent in preparations for the trip to Montreal lake. Freighters had been so difficult to get that several loads of my supplies which the Hudson's Bay Company had agreed to forward for me were still in their warehouse at Goschen.

On March 27, my party proceeded to Montreal lake, while I remained in Prince Albert, expecting daily to get my large transit which had been sent to England for repairs.

On March 30, no word having yet reached me of the early delivery of this instrument, I made arrangements to have it forwarded to me as soon as it arrived, and proceeded north by way of Montreal road. On April 2, I caught up to my party which had just arrived at the north end of Montreal lake.

Five miles west of the lake shore, our road crossed Weyakwin river, over which it was necessary to throw a bridge one hundred feet long, as the ice had already been broken by the force of the current. The numerous large boulders which obstruct this part of the river helped materially to support and hold securely in place the bridge timbers which otherwise could not have stood the pressure of the drifting ice and of the rising waters of this turbulent stream.

From Weyakwin river the road was opened four and one-half miles farther west to the shore of Weyakwin lake, over which we had to travel on ice six miles north before coming to a stream, the general course of which is northwest. The ice here was showing signs of giving way in many places so that after the freighters had dumped their loads on the banks of the river they refused to help us any farther, and I had to pay them off.

After their departure my teamsters made repeated trips between the river and the cache which some of my men were building, while others were continuing the sled road northwards to our next camping ground.

On April 13, we began the survey of the third meridian at the northeast corner of township 64.

Proceeding north of the seventeenth base line our surveys were at first carried through a hilly section of burnt country where large areas covered over with decaying fallen timber intervene with woodlands; but the trees, such as the banksian pine, spruce, poplar and birch are too small to be of any commercial value. Much brushy land which could be easily cleared was also noticed; the soil is clay loam, but it is inclined to be stony; the land is less so in the north half of township 65 where the soil consists of sandy loam.

In section 25, the meridian intersects a valley bordered on its north side by a wide strip of timber, where the trees measure up to ten inches in diameter. The general direction of this valley is northeast and its bottom lands include a few small hay meadows drained by a stream rising in tamarack swamps which extend far west of the meridian.

The slopes of the hills south of this valley and some of the wide ravines that lead to its bottom are generally denuded of timber or brush, and I noted that where the snow had melted away the hillsides were covered with dry grasses and pea-vine. It is therefore possible that during the summer months this section would afford fair pasturage for a few head of cattle. Eastward these hills slope down to Two Forks river, whose valley runs parallel to that of Montreal river.

In township 66 the surface is more regular. From the east outline the land rises gradually to a low divide, located three miles farther west, and beyond which all the streams flow north. This tract of country is very stony and wooded with banksian pine from four to ten inches and spruce four to six inches while on the top of the hills which rise west of it, poplar six to ten inches in diameter grow. The low lands which surround these hills are strewn with deadfall which makes travel very arduous. In this vicinity there is a lake and several large swamps. South of these the surface is light and rolling and covered with second growth timber. Northwards is a range of high hills close on to the north boundary of this township.

West of the divide, several deep creeks intersect the meridian. They are the headwaters of Twoforks river. Owing to the season, when our surveys were made, each of these streams crossed by our road was overflowing its banks, consequently we had to build bridges over them. To expedite this work we often utilized the beaver dams as a support for the timbers, when suitable logs were scarce or would have had to be hauled from too great a distance. For crossing the widest streams large rafts, strongly bolted, were used.

The streams were not by any means the only daily obstacles to our progress, for mile after mile of boggy ground, too soft to bear the weight of the loaded pack ponies, had to be corduroyed or brushed. Unlike the bridges, these brushed roads required constant repairs till the whole camp outfit and supplies, which amounted to several tons, had been carried over them.

These muskegs and swampy lands extend to the correction line. Then comes six miles of undulating country with drier, although very stony land, drained by the river which now turns to a northwesterly course and crosses the meridian in section 25, township 67. At intervals in the valley of Twoforks river, the timber cruiser reports having seen bluffs of spruce trees averaging twenty inches in diameter.

Starting from the corner of section 12, we travelled west through pine woods on the north side of the valley, varying from a quarter to half a mile in width. On its bottom grow dense willows and alders amongst which meanders a stream flowing east. The south side of the valley is also wooded, but the land is more broken by ridges. At one mile and a half from the meridian I came to a rapid; here the valley is only a few chains wide and the pine forest reaches almost to the creek. The trees are of a good growth. Above the rapids another valley from the south meets the one I was following, and through it flows probably the same stream I had crossed farther south in a previous exploration. Beyond the junction of these streams the pine ridges to the north gradually descend to the level of a low tract of land. The main stream now turns toward the southwest, and soon divides into several small branches. After travelling west for several hours through a wet and mossy section, with tamarack and spruce from six to eighteen inches, I returned to the line by way of section 1, where I crossed a ten-acre patch of spruce from six to twelve inches and balsam six to ten inches in diameter.

One mile north of Twoforks river the country is also low, but as we enter township 68 from the south the ground rises again and banksian pine up to ten inches is the most common timber. The surface becomes more even from there on to section twenty-four but the ordinary features of stony land and scrubby timber recur. Half a mile west of the east boundary of section 12, township 68, is a hay meadow covering about two hundred acres. In section 13 the line crosses another stream flowing northwest, and with some wild hay growing along its banks. Beyond, are large bogs separated by narrow strips of higher ground; these spread to the eighteenth base line. In these grow spruce, tamarack and birch of inferior quality

North of the base line, the explorer reports the same conditions to prevail as far as a creek, the outlet of a large lake located at three miles east of the township corner. Beyond the creek the land is better drained and supports a good growth of pine and spruce.

From section 25, township 68, we cut a trail to Montreal rapids, a distance of nearly eight miles. This road was needed for bringing to camp our mail and supplies from Montreal lake.

From the right bank of Montreal river the trail was continued to Montreal portage a further distance of one mile and a half.; by following this portage two miles and a half, we arrived at the head of the rapids. On the point formed by an elbow of Montreal river at the rapids, is a strip of spruce of good quality and size and suitable for lumber. Poplar up to eight inches is also found in patches surrounded by fire-killed timber. Where our trail strikes the rapids, Montreal river is seventy-five yards wide, its banks at this point being very low.

East from the corner of township 68, there is a low section of country supporting a poor growth of spruce and tamarack. High land is found only as we approach a lake nearly five miles long and surrounded by poplar and pine woods where the timber runs up to ten inches in diameter.

After crossing two small brooks which enter the south end of this lake, swamps intersected by a few low ridges are again met; they spread east to the river banks at Montreal rapids.

Explorations conducted farther south, across township 67, ranges 26 and 27, west of the second meridian, showed that the country there was very boggy and that the only dry land consisted in a strip about two miles wide along the left bank of Montreal river. The soil is a clay loam, apparently free from stones; poplar, pine and birch are the trees which grow in this vicinity. Throughout the country adjacent to the third meridian there is practically no grazing land except along the edges of a few streams, where scanty grass of the coarsest variety grows on land so quaky or imperfectly drained that horses did not dare to venture on it. The cause of this excess of water is due partly to the dams which the beavers have built at short intervals along the streams.

EIGHTEENTH BASE LINE.

The north boundary of township 68, range 1, runs through continuous spruce or tamarack swamps and open marshes lying along the foot of a range of hills north of Twoforks river, which flows in a northwesterly direction across the township.

These swamps extend as far as the river in section 25, township 68, range 2. Here its banks are twelve feet high and fringed with willows, back of which is a strip of large spruce trees measuring up to thirty-six inches.

In section 32 another important stream also intersects the base line, and meets Twoforks river three miles farther on. Between these rivers the land is almost level, and better drained. It is stony and covered with scrub; the soil is light. As the open land adjoining this stream was the only place where grass grew, the horses had to be held in this vicinity till we had found new pastures farther west. All our stores were also kept there for a considerable period, small quantities only being brought to the main camp as they were required.

One of our ponies mysteriously disappeared from the camp, and although a diligent search was made for him during several days, no trace of his whereabouts could ever be found.

The surface of township 68, range 3, is broken, but more so in the south half of township 69 where rises a succession of sandy hills almost denuded of vegetation. North of these is a wide depression, with a large lake discharging by an outlet a mile and a half long and seventy yards wide into Twoforks river. Along its north shore the land is level and sparsely timbered for two miles, when the ground rises gradually to wooded hills in the centre of township 70. South of the base line, the country is rolling and dotted with numerous lakes of varying sizes. The land is generally well wooded, although the timber is not very large. The soil consists of clay loam, eight inches deep; the subsoil is sand.

In range 4 we came to the valley of Smoothstone river, the outlet of Smoothstone lake which lies twelve miles south of the base line, and is one of the largest bodies of water in this district. This river first crosses the line in section 31, thence its course is nearly east for three miles, when it divides into several channels, with hardly any perceptible current. The principal one turns south across the line in section 31 and soon after discharges into a lake which covers nearly all of section 34.

Up to the place where the river divides, its valley is well defined by high hills which extend southwesterly along its course to the rapids where they slope down to benches fifty feet high. Farther south these benches merge with the level country along the north shores of Smoothstone lake. The navigation of this stream, which is frequented by the natives from Snake lake, is feasible by canoes for a distance of four miles south of the line where the rapids begin. They are reported to extend without interruption to the place where the river flows out of the lake.

In the other direction, as far as the large lake that covers a large area of townships 69 ranges 3 and 4 there are no rapids; in the narrowest stretches of river the channel is quite deep and the current slack. Along this route, Smoothstone river often expands into lakes with shallow bays, the favourite haunts of ducks, which were in great numbers at the time of our exploration.

On July 6, I left my camp on Smoothstone river, near the corner of township 68, range 5, to explore the country between the base line and Smoothstone lake. On this trip I was accompanied by the timber cruiser, and we used the canvas boats, intending to travel by water eight or ten miles, and then establish a camp from which our explorations would cover ground which might have been inaccessible if these had been carried on from the line, but we had not travelled more than four or five miles from the main camp before we came to the foot of bad rapids. On the way we had passed a bend where the river bifurcates; one branch, almost blocked up with jammed drift wood near its head makes a long detour to the east, but joins the main river again a mile and a half farther down, forming the only large island seen in

this part of its course. Along the left bank are a few large spruce, and small patches of the same timber grow half a mile farther west.

The banks of this river are seldom over five feet high and are grassy, or covered with willow, except near the rapids, where the woods extend to the water's edge; the current is very variable.

The basin drained by Smoothstone river must be very great, for I noticed that after a few hours of steady rain the water rises very fast and is liable to overflow the banks of the river.

Fearing to tear our canvas boat on the jagged rocks which obstruct the river, we decided to go afoot along the river bank and to ascertain the length of these rapids. After travelling for several hours, sometimes on pine flats, but mostly through dense willows, and seeing no slack water, we returned to the place where our boat had been left and prepared camp for the night.

The next morning the timber cruiser paddled across the river and started in a southerly direction, whilst I went on a course that would allow me to explore a strip of country three or four miles west of the river, after which I intended to turn southwesterly towards Smoothstone lake. When I had travelled for a quarter of a mile over a wooded flat I climbed a high bench on top of which are banksian pines, poplar and some birch. The country ahead was almost level, and although it was well drained in the first mile, owing to the proximity of the river, it gradually turned to marshy lands covered with decayed fallen timber, amongst which some wild hay grows. Farther on I crossed a small stream, tributary to the river, and continued my journey in tamarack, spruce and scrubby birch and thick willow over ground that was decidedly boggy. Towards the latter part of this day's explorations, I came to a much larger stream, flowing from the northwest, and to the right I could see many high hills. Then I struck southeast towards the valley of Smoothstone river which I approached through dense woods and extensive mossy swamps of tamarack and scrubby spruce. These extend to the river, where I could still hear the sound of the water rushing amongst the rocks. The natives must travel along this valley during the winter, at least, for I saw signs of their passage. The country east of the river is quite different to the section I had explored that day; it appears to be very hilly, although densely wooded. When I met my companion that night by the camp fire he was so wet from head to foot that I imagined he had attempted to cross some river. He reported having travelled over a rough country, and climbed up hill after hill with only bogs between them. When near the end of his day's journey, he had seen a large lake two miles farther on and southeast of the course he was making. On July 8 we returned to the line.

Beyond the high stony ground that defines the west of the valley of Smoothstone river, the surface of range 5 becomes more even, but one-third of this land is swamps, covered with scrub tamarack, spruce and birch, except along their edges, when the trees are somewhat larger.

Good timber is still found in patches south of the line, and consists of spruce from six to twenty-four inches, poplar from six to ten inches, and banksian pine from four to eight inches in diameter. The preservation of the timber in this locality is due to the numerous lakes, which are all connected with bogs. This has prevented further inroads of the forest fires in that direction. The soil consists of ten inches of clay loam overlying a subsoil of gravel.

Near range 6 we came to a high and broken country which continues for several miles along the east and north boundaries of township 69, range 6, leaving towards the south a sort of basin in which is a chain of lakes of varied sizes. From these hills spring many brooks discharging into these lakes, whose overflow forms a large creek which runs south in section 31, and carries to Smoothstone river the drainage of this section, and also part of the surplus water from the wet lands in the northern part of township 68, range 7, by a west tributary which empties into it in township 68, range 6.

From the report of the explorer who visited ranges 6 and 7, north of the base line, I note that he travelled close to the outline between ranges 6 and 7, passing first some scrubby land, and also a lake two miles long and from ten to sixty chains wide. He then ascended to the summit of high hills which are wooded with a fine growth of poplar measuring up to ten inches. This, however, is only a belt of large trees which runs northeast.

Continuing north, he soon arrived at a stretch of country which had been devastated by fires, and where large numbers of scorched trees were still standing. His progress was now much hindered by deadfall, but as the ground was dry and fairly level, he pushed on to the correction line, four miles farther, passing on the way a valley with a small stream, to which he returned to camp for the night. From this place he explored west, crossing in section 33, township 70, range 7, a stream running south. Near the corner of range 8 he ascended some high hills with banksian pines and small poplars. On the following day he proceeded three miles east through a burnt-over but flat country, after which he crossed another part of the same high poplar ridge which he had seen near the corner of township 69. This ridge continues north, but towards the east it slopes down to swamps and muskegs, which he also explored, meeting at intervals strips of spruce from ten to twenty inches in diameter, and saw several small streams, all flowing north. From the top of a tree he saw in that direction a great depression, which may be where Snake lake lies. He reports some high ground at five miles farther east on the correction line. This I had also noted when I was surveying in ranges 3 and 4.

The high and well defined poplar ridge above referred to would therefore be the division in the drainage to the basins of lac La Plonge, Snake lake, Doré lake and Smoothstone lake, which are all very large bodies of water.

In range 7 we encountered many swamps, separated by mossy ridges, but no grass of any kind, and for a while the ponies had to shift the best they could till we had arrived at range 8, when we discovered, between low ridges covered with deadfall, a small lake with a strip of coarse grass along its boggy shore.

In section 35 we entered a drier country with signs of a very recent fire, from which must have arisen the smoke which had previously interfered with my observations. Our cache of supplies was only a few miles south, and for a while I felt very anxious. I was therefore greatly relieved when the timber cruiser, whom I had sent to Doré lake, returned to camp with the news that this local fire had died out before reaching the shore of the lake where the cache was located. Northwards it had burned fiercely through some dry deadfalls and pine woods as far as the south edges of a muskeg, six or eight miles long, which extends in a northwesterly direction almost to lac La Plonge.

From section 35, in range 8, the line traverses the northern spurs of rough hills which extend south to Doré lake shore. Westward they cover nearly one-half of range 8 and almost all of range 9, when they descend to the low lands on which is located the new winter road opened by the Isle à la Crosse Fish company. This road is only seven miles long and connects Doré lake to lac La Plonge; the country between them is level, except when approaching lac La Plonge where it is hilly. At half-way between these lakes in another smaller one. This section is covered with tangled willow and scrub tamarack or spruce.

The portage over which the trappers used to travel between the above-mentioned large lakes intersects the base line at half a mile west of the corner of township 68, range 9. By this portage the distance between Doré lake and lac La Plonge cannot be less than twelve miles. It starts three-quarters of a mile east of the high escarpment on the north shore of Doré lake, and for about two miles it runs through a fairly level timbered country, following in places the shores of small lakes. Thence the land rises and the road crosses some high ridges, after which it descends again to a sort of pass between the hills where there is a continuous chain of small ponds, with some wild

hay along their edges. After crossing the line it turns northeast to the divide, three miles farther on. This part of the trail is blown over with dry trees, and is difficult to follow. After crossing a small stream flowing towards lac La Plonge, it ascends to a plateau covered with scrub, which the explorer classified as very good soil. This plateau spreads four miles farther to the shores of lac La Plonge, where it descends abruptly.

The country west of the trappers' trail has been devastated by fires, but on the hills, east of it, grow large poplar and banksian pine. Fair-sized spruce was seen near a few of the small lakes and also in strips on the points of Doré lake and at different places along its shores, notably on some high ridges back of two small bays on the west shore. At three miles off this shore there is a very large island whose surface rises from the water's edge to the summit of a high hill which occupies its south half. Nine other islands of different areas and separated by narrow arms of the lake are scattered in a northeasterly direct between the largest one and the head land on the north shore.

Another group of islands lies in the south bay into which Sled river discharges, whilst a few more are also located in other bays or close to the shores. All these islands are timbered.

West of the fisherman's road which leads to lac La Plonge is a strip of undulating country which extends to the centre of range 10. From there on the surface is rough, but only for a short distance, as more level land appears again beyond the ridges. This part is generally swampy, but it was noticed that many of the swamps were nearly dry, indicating that the drainage which goes south to Doré river finds a better outlet from most of the low sections we had crossed so far. Tamarack from four to ten inches in diameter were seen in several places and is the only timber of any value; the rest consists of second-growth poplar, spruce, banksian pine and birch. The soil is poor, being composed of sand, gravel and stones. At the corner of section 34 we crossed the new road to Isle à la Crosse and, one mile and a half farther, Olsen creek which rises from a lake three miles and a half north of the line. This creek is forty links wide, but was not running at the time of the survey, the water, which was very good, being found in deep pools closed up by boulders which fill the bed of this stream at intervals. This creek runs close to the line across sections 33 and 32 until it connects with Doré river four miles farther on.

In township 70, range 11, a great amount of large timber was destroyed by a fire that started early in the season and spread even to the shores of lac La Plonge. Traces of this fire were also seen north of La Plonge river, when I was travelling between the mission and the west end of the lake. The distance across is about four miles.

West of Olsen creek, and as far as Beaver river, in section 34, township 68, range 12, the soil is very good, and consists of sandy loam eighteen inches deep. The fires which swept over this section years ago did not extend their destructive work beyond range 12, where the green timber begins again and the forest continues unbroken to the valley of Beaver river which, on the east side, is bounded by high detached hills with narrow valleys, where we found many ponds fringed by hay meadows. At the crossing of the line, the Beaver river is ninety yards wide and its banks are about ten feet high. In the main channel the water is from four to eight feet deep, with a current averaging two miles an hour. From both sides of the valley the poplar woods extend to the banks of the river.

A quarter of a mile south of the line, Doré and Beaver rivers meet. At that point there is a pronounced horseshoe bend in the river, east of which is an overflow lake with extensive hay marshes along part of its shores. Half a mile above the confluence of these rivers are high sandy cut-banks on top of which some trappers erected a shanty which we were glad to use this fall to store our supplies as they were being brought down from Green Lake trading post. In that vicinity we also came across a sled road leading almost due west to Long lake, three miles and a half west of the

river. The old "freighter's road," used in the early days by the half-breeds from Green lake did not pass by "Grand rapids" but followed another valley or depression nearly parallel to that of Beaver river and only a few miles farther west. In this depression are many open swamps and lakes which, with Long lake, formed an ideal winter road, as there were very few steep hills to ascend, and also giving a most direct route when compared with the one opened later on along Beaver river, whose bends and turns it generally follows.

The Hudson's Bay company used to have a depot on the right bank of Beaver river, at the foot of "Grand Rapids," but last summer the buildings were pulled down, and the lumber collected into a raft which was floated down stream to Isle à la Crosse, so that, at present, there is no accommodation for travellers between the mouth of Waterhen river and Kennedy's house, which is about four miles south of La Plonge post. At two miles above "Grand Rapids" are some hay meadows close to the banks of Beaver river, and it was from these that the Company used to procure all the hay required by their freighters. This year they sent some of their hired men from Isle à la Crosse to put up hay for my ponies, but many of the stacks must have been built when it was raining, for, in the fall, I found this hay all mouldy and heating to such a degree that smoke was issuing from it. There are other hay flats along the banks of the river, below the rapids, but to be of any real value they would have to be cleared of the clumps of willow growing on them. They would also require considerable drainage, and it is not very apparent how this work could be carried on successfully, in most cases, for their surface is very little higher than the present level of the water of Beaver river, and the surplus water, which is the overflow from springs rising in the hills bounding both sides of the valley, is held back by an embankment whose top, covered with thick willow, rises six to eight feet above the level of these meadows.

Between " Grand Rapids ," which is five miles north of the correction line in township 67, range 12, and the confluence of Beaver and Doré rivers, the banks are generally six to twelve feet high except in two places, where, on the west side, are high sandy cut-banks, the highest ones beginning near an Indian trail which leads northwesterly to Long lake.

The country west of this portion of Beaver river is broken by steep hills, on which banksian pine, from six to ten inches in diameter, is the prevalent timber. This hilly country goes three miles and a half farther west to the depression of Long lake, a body of water of variable width but nearly eight miles long. The line struck this lake, which lies almost due north and south, near its center, and three-quarters of a mile south of its narrowest part, which is less than fifteen chains wide. Here we had intended at first to ferry the camp outfit on rafts and swim the horses, but after carefully examining both shores which are simply quaking bogs merging into clear black mud far into the lake, I saw the danger of risking our ponies in such a treacherous place where they would certainly have sunk and been drowned. To go around the south end of this lake and its many deep bays meant the opening of at least twelve miles of road, part of which would have to be brushed or corduroyed.

After the shores of the lake had been further explored, firm ground was found north of the Narrows, and although the lake is quite wide at that spot, I did not anticipate any trouble in swimming the horses over to the opposite shore provided no wind should rise on the lake while crossing.

While a strong raft was being built for transporting the camp outfit and supplies across the lake, a path was cleared around the deep bay, south of which our camp was situated, in order to bring the pack animals to the crossing. When the time came to send the horses across, several Indians who had spent the summer in this vicinity offered their services, which were gratefully accepted.

After the whole outfit had been transferred to the west shore of the lake, the survey of the line was resumed. In section 35 of range 13, it intersected again one

Photo by G. H. Blanchet, D.L.S.
Nineteenth Base Line West of the Fifth Meridian, Across Christina Valley.

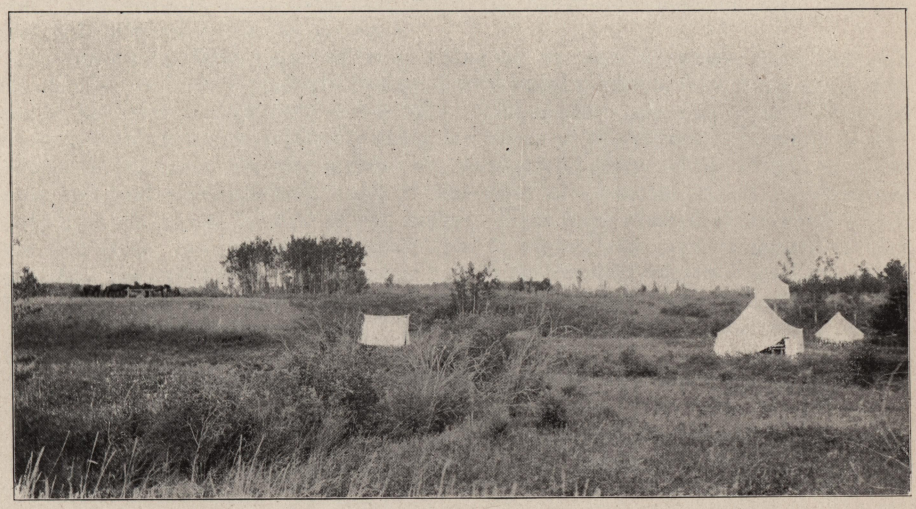

Photo by J. S. Galletly, D.L.S.
Camp in Township 109. Range 14, West of the Fifth Meridian.

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of the deepest bays of this lake. Beyond the bay, the country is a succession of wooded ridges with great marshes almost to Burnt river, a swiftly running stream a chain and a half in width, and with numerous rapids. It flows out of Burnt lake at a point on its east shore, one mile south of the line.

This large lake lies partly in townships 68, ranges 14 and 15, and extends south to the north boundary of township 67, range 14, while northwards its shore runs one mile beyond the base line. It is very shallow, especially along its west shore, where wide mud banks spread far into the lake.

DESCRIPTION OF THE COUNTRY WEST OF BEAVER RIVER.

Strips of rolling land, separated by narrow but deep valleys, following a north and south direction form the principal feature of the country west of Beaver river. Two of these valleys deserve special mention.

The first one west of the Beaver valley follows closely the outline between ranges 12 and 13 for fifteen miles, but in section 24, township 70, range 13, it turns northwest, and eight miles farther on it meets the other valley in which Burnt river flows almost due north to Canoe lake. The valleys join at the north boundary of township 70, where Burnt river receives its principal eastern tributary. From the confluence of these streams the main valley spreads out to the nearly level section of land surrounding Canoe lake, where there is an Indian village.

In the first-mentioned valley, there are, besides Long lake, three others from two to four miles long and connected by streams that are navigable for canoes. There are small islands in every one of these lakes. The outlet of the most northern one flows northwest for five miles before joining Burnt river. Soon after it leaves the last lake the only rapids which interfere with its navigation occur. Through these, the Indians have made artificial channels by removing a large number of boulders, but as, at the time of our visit (October 11, 1912) the water was very low, it was not advisable to risk the canvas boats in such places, and the exploration of the country to the valley of Burnt river had to be done on foot. Below the rapids, the creek winds in a valley from a quarter to half a mile wide. In several places I saw some hay meadows along both banks, although most of the bottom lands are covered with clumps of willow. This creek is about three feet deep; its banks are nowhere high and its current will average two miles an hour.

The prominent long range of hills rising at variable distances from the east shores of all these lakes is sparsely timbered with small poplar and in many spots they appear to be covered with light scrub only. The country adjacent to their western shores is low and swampy, especially along the banks of the stream in sections 31 and 32, township 69, range 12, which joins the second and third lakes. North of these swamps the land rises gradually and at the creek the benches attain an elevation of forty feet above the bottom of the valley. Fires have cleared large areas of all timber and moss; the soil is remarkably free of stones, and consists mostly of clay loam. Near the valley of Burnt river the tops of the benches support a good growth of poplar, and I also saw some spruce, cotton-wood and birch nearer the creek. On the north side there is quite a high ridge where banksian pine is the most common timber.

The valley of Burnt river is covered with tangled willow and alder, which are almost impenetrable.

South of the swampy land found in the northwest quarter of township 69, range 12, there is yet much green timber, generally large poplar and pine. The forest continues south of the base line.

Between Burnt lake and the seventeenth correction line is a wide section of low lands, drained by two large streams and their tributaries. Both streams enter the lake at its south end, and their estuaries are only two miles apart. The first one is

fifty yards wide, has low banks and for a distance of four miles from the lake shore, its current barely perceptible. At that point it branches. Although the left branch is the wider and deeper of the two, it has much the appearance of a slough receiving the overflow or seepage of the marshes which adjoin it. I believe it branches off in every direction among these marshes as is often the case in this country with streams in which no current can be detected. However, I did not have time to investigate this matter as it was then October and the days were getting shorter, and I had to explore the other branch which had well-defined banks. We had not paddled up that last stream very far before we noticed that the current was gradually increasing, the stream all the time winding across a nearly level country covered with low bushes. At one place we saw a few spruce measuring up to thirty-six inches in diameter and from the time which had elapsed since we passed the forks I concluded that we must have been then very close to the correction line. Before turning back, the explorer climbed the tallest of these spruce and from his observation point he saw some hills about two miles to the southeast and others considerably farther in a southwesterly direction. The rest of the country is described as flat and covered with small willow, birch and other low bushes. This low country is probably the continuation of the open and impassable bogs we had encountered on the other base line. Where we turned back, the stream was forty links wide, about five feet deep, with a sandy bottom. Its banks never rise above five feet and were everywhere covered with a thick clump of willow. The water was very clear and teeming with whitefish.

On September 12, I left my camp at Long lake and travelled to Beaver river, and thence proceeded by boat to La Plonge mission, twenty-eight miles farther down stream in order to buy some provisions and get my mail, which through a misunderstanding had been carried north instead of being delivered at the line.

A short distance above La Plonge village, Beaver river divides into several channels. To reach the mission landing one must follow for a distance of two miles the most eastern one, less than a chain wide in places, and very tortuous. This branch of Beaver river approaches a high and well-wooded ridge where it meets La Plonge river which has to be ascended a considerable distance in order to make the landing.

An alternate route, sometimes used by the Indians who go to the mission, is by portaging the canoes across the hay marshes which are in this vicinity the principal feature of the Beaver valley.

La Plonge river runs close to the foot of the bench where the orphanage and the other buildings of the mission stand. These are lighted by electricity and supplied with water for domestic purposes by power derived from La Plonge river. The same water-power drives the machinery in the saw-mill and planing-mill which belong to the mission. In this neighbourhood there is a large acreage under cultivation, part of it being in gardens where all kinds of vegetables grow luxuriantly, and the rest in fields of oats and barley that never fail to mature. Hay in unlimited quantities can be procured from the flats along Beaver river.

After securing my mail and purchasing supplies, I proceeded at once to the line, where I arrived on September 16.

All through the lands explored last summer, most of the timber is second growth. There has been very large spruce in many places at some former time. But fires have swept over this country so often that now there is very little milling timber, although in some sections the trees grow large enough to be suitable for railway ties, telegraph poles, piles, etc.

Much of the smaller timber could be turned into pulp. It has now been demonstrated from experiments that the banksian pine (so commonly met in this northern country) is entirely suitable for the manufacture of newspaper.

The immediate source of revenue for many years to come will be principally derived from the fishing industry. The companies which are licensed by the Government to carry on this trade, are yearly extending their operations by opening new

routes to lakes which are known to be well stocked with the best varieties of fish, but which, owing to the lack of roads, were inaccessible except to a few nomad Indians. The catch of whitefish alone, in the northern part of this province was last winter estimated at three million pounds, which sold at a very remunerative price. Lake trout, which a few years ago was not marketable, now meets with a good demand, and as it is only caught in certain lakes the price is sure to rise; of the other varieties, such as pickerel and pike, which are found in all lakes and streams, enormous quantities are annually disposed of, but by the wise protective laws enforced by the provincial authorities, there is no danger that these lakes will ever be depleted. So far this industry has been carried on only during the winter, but some of the railway companies are beginning to see what a large revenue this new industry can be made to pay them, and consequently they are preparing to supply specially constructed cars to handle properly this food product at all seasons.

The fish industry is yet in its infancy in the province of Saskatchewan, but it is sure to develop in the near future, insuring an ever increasing source of revenue to the Government and a good income to the parties who have invested their capital in the enterprise.

The Isle à la Crosse Fishing company, who are the leaders in developing this industry here, have spent large sums of money in opening a winter road to La Plonge mission, one hundred and ten miles north of Big River. Their road affords a most direct route and the easiest grade for the increasing northern trade, and the Company is encouraging the freighters to travel over it by building at shorter intervals new stopping-places and changing the original location of these where the supply of water sometimes failed during the coldest weather.

The manager of this Company has offices at Big River station, which is the terminus of a branch of the Canadian Northern railway and the distributing point in this province of the output of the Company's fisheries.

On October 5, the survey of the eighteenth base line had been carried to the west shore of Burnt lake, near the middle of range 15, but poor and insufficient grass, since we had left Long lake, added to the inclemency of the season, was playing havoc with my pack animals, which were gradually weakening under the strain put on them in transporting our outfit. Under such conditions, and with the knowledge that the hay put up for them in the Beaver valley was too much spoiled to be of any use, I was compelled to suspend my operations for the season. When returning to the valley of Beaver river the men widened and otherwise improved the pack-trail, so that it could be used for sleds later on, taking advantage for this purpose of all open swamps and muskegs.

A few miles above "Grand Rapids" our road connects with the freighters' road to Green Lake.

On October 22, when I arrived at the mouth of Waterhen river, I was able to procure from a squatter some loose hay for the ponies, which were kept there till the morning of the 24th, for a much-needed rest, and also because we had been informed that before they could reach Green lake (a three days' journey) they would have to feed on what frozen grass they could pick along the road. I also had to rent a shack and store part of our outfit which was too cumbersome for the number of horses that were still fit for packing.

On October 24, we crossed Waterhen river and continued our journey southward over the Government road opened last summer through the woods along the left bank of Beaver river, as far as Waterhen river.

This road makes a junction with the Green lake trail south of Beaver river. It is fairly straight, well located, and when graded will be of great assistance to the incoming settler now that this section of country is all subdivided.

On October 24, we camped for the night at Rat creek, and the horses were driven to some hay marshes up the valley.

In the afternoon of the next day we came to the valley of Beaver river. Although there was, north of the river, an extensive hay meadow where our ponies might have had plenty of grass, such as it was, I did not consider it wise to stop at this place. In the early part of the day I had seen much floating ice on the river and I feared that if the outfit did not cross immediately, we might later on be much hampered, if not actually stopped by it. So we went to camp on the opposite side of the river, everyone wading the best he could through the icy waters which, in places, reached well above the waist. At this crossing there is a rapid and the ponies had to follow a circuitous way before they came to the river bank.

Last summer the Dominion telegraph from Battleford was extended this far, and will soon be continued north.

Quantities of telegraph wire have been shipped here, and many telegraph poles have also been handed to the new road, ready for continuing this line to Isle à la Crosse.

Lately a branch of this line has also been built to Green Lake trading post, and I am informed that a telegraph office is now opened at this post.

On October 26, we arrived at Green Lake, where arrangements were made with the mail carrier who was going to Big River for carrying part of the men's baggage so as to lighten the ponies. We were six days on this trip. At Big River we took the train to Prince Albert, where we arrived on November 5. My party having been padi off, I started to make preparations for continuing my surveys during the winter.

GENERAL REMARKS.

Last season was a particularly bad one from a surveyor's standpoint. Unfavourable conditions for observing, due sometimes to smoke but more often to long spells of cloudy weather, interfered much with astronomical work, and for that reason I did not get as frequent observations for checking the bearing of the line as I desired.

In the district where I was surveying, frosts occurred during the nights of June 4 and 5, and again on the nights of July 16, 17, 19 and 20, when ice a quarter of an inch thick formed on water kept in receptacles in the tents. These frosts were also felt at La Plonge mission, where the barley suffered to a certain extent, although oats stood them well.

No minerals were found along the lines surveyed, but the abnormal declination of the magnetic needle in the first ranges west of the third meridian would indicate the presence of mineral deposits along a belt which extends southerly across the seventeenth and sixteenth base lines, because the same irregularities were noticed there at the time I surveyed these lines.

Beavers were seen at work on all streams in the country adjoining the third meridian. Bears are quit common, also coyotes, foxes, lxnx, marten, mink and weasels.

APPENDIX No. 44.

ABSTRACT OF THE REPORT OF B. H. SEGRE, D.L.S.

MISCELLANEOUS RESURVEYS IN SOUTHERN SASKATCHEWAN.

I organized my party at Regina and, on August 31, 1912, left for Raymore to investigate the duplicate monuments reported to be found at the northeast corner of township 27, range 19, west of the second meridian.

Raymore is a thriving settlement of about two hundred inhabitants, situated on the Grand Trunk Pacific railway, and was at the time of my survey the headquarters of the Pearson Land Co. There are no water-powers or streams near, the water supply being obtained from wells. The soil in this locality is a heavy black loam, producing excellent crops, the average yield of wheat being in the neighbourhood of thirty-five bushels per acre. There is a considerable amount of scrub in this locality and, the district being new, very little clearing has been done.

On completion of the investigation which was delayed by continuous rains, and having destroyed the erroneous monument as instructed, I left for Yorkton by way of Melville, on September 10. My work there was the investigation of portions of the northeast quarter of section 34, township 26, range 2, west of the second meridian. This was completed on September 17, and I returned to Yorkton on the following day. Yorkton is one of the important towns in Saskatchewan, being situated on the branch of the Canadian Pacific railway from Winnipeg to Edmonton and on the Grand Trunk Pacific branch line to Canora; it is expected that the Canadian Northern railway will also enter the town shortly. The town is lighted mostly by electricity and has also a municipal acetylene plant. There are several banks and churches, and the International Harvester Co. have just completed a large warehouse and distributing plant. The only river in the vicinity is a small stream called Whitesand river. The sewage therefore has to be treated in a septic tank before being allowed to flow into this river.

I left Yorkton on September 19 by way of Saskatoon for Duck Lake settlement, arriving there on the 20th. This is a small settlement of about seven hundred inhabitants on the branch of the Canadian Northern railway from Regina to Prince Albert, and is the centre of a large and prosperous farming community; there are several churches, a bank and an industrial school for the Indians located there. On September 24, I left for township 46, range 3, west of the third meridian, to investigate the conditions in sections 22 and 15 as a result of duplicate monuments being on the ground. I made the necessary changes as instructed, completing them on November 19. The soil in this locality is of a light sandy nature, the district is not being settled rapidly on account of the thickness of the scrub, many sections requiring a great deal of clearing before extensive farming operations could be carried on. There are numerous sloughs in the vicinity of township 46, which would make the locality more suitable for the raising of stock than for grain, as ample hay could be secured along these sloughs for feeding in winter. On account of the trouble arising from the duplicate monuments, no road improvements of a permanent nature are being carried on, and these are badly needed, as the farmers have to wait for the snow in order to move their grain for shipping, thus losing the advantage of securing the better prices of the early markets.

On completion of my work at Duck lake, I left by way of Saskatoon for Renown. I arrived there on October 4 and made an investigation of the width of the road allowance along the correction line between township 30, range 27, and townships 31,

ranges 26 and 27, west of the second meridian. I corrected the error along the south boundary of section 6, township 31, range 26, and made investigations which showed that the error extended along the correction line both east and west from the lines ordered to be surveyed. The district is well settled, and, being very near the railroad, should go ahead very rapidly. The soil is of very good quality but is underlaid with large granite boulders. Grain is shipped from Renown on the Canadian Pacific railway, but most of the settlers go to Watrous on the Grand Trunk Pacific for provisions, etc., hence there is only one store and a lumber yard at present in Renown. The water in this locality has an alkaline taste, but is easily obtainable by sinking wells.

Having completed the above investigation, I left for Davidson on October 12 by way of Saskatoon and arrived there the same night. On the 14th, I went to work in township 28, range 27, west of the second meridian, a distance of twenty miles from Davidson. The work here consisted in investigating the error in the position of a witness mound marking the northeast corner of section 16. This error was located in the southeast quarter of the above section and on completing the lines around the block I found an error of one chain in the lengths of the east and west boundaries of this block. As the lands were patented and the owners of the southeast and southwest quarters of section 16 would be losers if the quarter post on the east boundary only were changed, I submitted a report to this effect and on receipt of a favourable reply on October 26, I returned to the township and made the necessary corrections suitable to the different owners. I also placed posts at the quarter section corners where none had been erected at the time of the original survey, through the presence on the ground of sloughs which since have dried up.

This locality is very thickly settled to the south and west of this work but, as the land rises to the north and east and is very much broken up by valleys, settlement is retarded for a time; also the lack of railroad facilities is keeping the locality back, the drive to Davidson being twenty miles, with one steep climb out of the valley of Arm river. The drive to Imperial is only fourteen miles, but the road is very rough, hence Davidson is preferred by most of the settlers. All the sloughs here have dried up considerably, and many farmers experience difficulty in securing a good supply of water except at a depth of from sixty to eighty feet. Davidson, the main outlet for the grain of this community, is a very enterprising settlement of about 800 inhabitants; it owns an electric lighting plant, power being generated by a gasolene engine. On October 28, H.R.H. the Duchess of Connaught laid the corner stone of a hospital to be erected there. There are several churches, two banks and five grain elevators; I was also shown some samples of brick made of clay obtained from a farm a few miles out of town and they were very good indeed. It was the intention of the promoters to interest capital in the venture and get started manufacturing brick as soon as possible.

Having completed these investigations, I returned to Davidson on October 19 and on the 21st left for Rosemae to investigate a lake on the southeast quarter of section 16, township 25, range 3, west of the third meridian. As a result of my investigation I found that although this quarter section was lower than the surrounding land, the water had dried up since the original survey was made. There was a rich crop of vegetation growing on the quarter and hay had been cut from it for many years. From present appearances it is not likely that this quarter will ever be under water again, and it is therefore quite suitable for farming purposes. I completed this work on October 24 and, returning to Davidson, I was engaged in preparing sketches until the receipt of your telegram of October 26 when I returned to township 28, range 27, and made changes as instructed. I completed these changes on October 28, and returned to Davidson.

On October 29 I packed my outfit and left for Aylesbury. The following day I drove out to section 2, township 24, range 27, west of the second meridian, to investigate an error on the east boundary of section 2. This error I located in the

northeast quarter of section 11, and found that it had been carried through to section 2. The lands there were nearly all held by persons residing outside the district and considerable trouble was experienced in locating the owners in order to have the petition signed. I also had some trouble in getting the present holders of sections 1 and 2 to come to an agreement over some improvements affected by the change. Having adjusted these matters and obtained the signatures to the petitions I left for Caron by way of Regina on November 6.

I arrived there on the 8th and left the next morning for township 16, range 30, west of the second meridian, but on receipt of a wire on November 13 instructing me to return to Duck Lake, I immediately drove out for my outfit and assistant and left for Duck Lake settlement on November 14. On reaching Regina after completing my work at Duck Lake I had to hire another assistant owing to my former one leaving. I next left for Mortlach on November 23 and for township 16, range 30, on the 25th. The work there consisted of destroying a duplicate monument marking the northeast corner of section 24 and this was done after due investigation. The surface is very rolling in this township and rises sharply to the east. It is, however, thickly settled and the soil is a good loam, producing excellent crops. This township may be reached from either Caron or Mortlach, small towns on the main line of the Canadian Pacific railway.

I completed the above investigation and, having received instructions to extend the subdivision lines across the dry portions of Pelican lake which lies north of Mortlach, I proceeded to that vicinity on December 2 and started on the extension of these lines. I found the southeastern end of this lake completely dried up, but the soil being alkaline the growth of grass is not heavy; the middle of the old bed in township 18, range 30, is still a little marshy but by draining towards the southeast the whole bed should provide good pasture land, and, after a few years ploughing, it should begin to produce grain. I carried these lines up to the third meridian and abandoned further operations owing to the depth of the frost retarding the progress of mounding.

On December 16, I left Mortlach for Pennant, where I arrived on the following day, to investigate an erroneous monument on the north boundary of section 10, township 18, range 17, west of the third meridian. I corrected this after noting improvements affected and returned to Regina on the 19th.

I then proceeded to Yorkton to obtain signatures to a petition for re-establishing the northeast corner of section 34, township 26, range 2, west of the second meridian.

Having received instructions to close operations for the season, I proceeded to Winnipeg where I stored my outfit. I then left for Toronto, arriving there on January 5, 1913.

APPENDIX No. 45.

ABSTRACT OF THE REPORT OF F. V. SEIBERT, D.L.S.

MISCELLANEOUS SURVEYS IN SOUTHERN SASKATCHEWAN AND ALBERTA.

The miscellaneous surveys on which I was engaged in the southern parts of Alberta and Saskatchewan were of widely different natures. They consisted in restoring and establishing obliterated and lost monuments; locating and correcting, where possible, errors in the original surveys; resurveying the beds of a number of prairie lakes which had dried up since the original survey; traversing the shores of lakes where the beds have sensibly altered since the original survey; investigating all manner of communications received by the Department from the settlers with reference to surveys. Briefly, the work consisted of those surveys and investigations on which it was not thought advisable to place a regular party and which could best be done by a surveyor and his assistant.

This work took me over the greater part of the prairie portions of Saskatchewan and southern Alberta. On every hand I found indications of prosperity. The most optimistic reports in the past of the possibilities of this country are being realized. Railway development is taking place in almost every portion of the country, improvements were noticed on every hand, and towns are springing up as rapidly as the railways permit. In a few months a settlement of one, two or three hundred people springs up where before there was nothing except the bare prairie. This is generally the case just as soon as freight can be taken over the newly laid steel and sometimes even before. But rapid as the development is, it cannot in every instance keep pace with the needs of the country. We covered some sections of the country where the soil and climatic conditions were of the best and where all the available homesteads were taken up. Yet it was so far from railway facilities as to make the growing of grain for sale a losing undertaking. In some cases the settlers had to haul their grain seventy-five to eighty miles to market. In the greater part of the country, however, the railways are following the settler very closely and in most cases just as soon as he has any grain to sell he has a railway to take it to market.

Covering as much of the country as I did I could not help noticing the excellent class of people who are making this country their home. Many of them were old pioneers, though more often sons and daughters of old pioneers of the Dakotas to the south, or Ontario to the east, or of other portions of America. Many of them brought money and settlers' effects into the country, while others came with almost nothing. Those who came with sufficient for a start were able to take advantage of the low price of land and to secure large holdings, while the poorest were able, after a few years, to extend beyond their original homestead and pre-emption.

This reaching out after more land in many cases leads to careless farming. A number of farmers in different sections of the country are trying to farm too much, with the result that their land is impoverished by weeds and their profit for any individual year is not as much as it would be on less land properly cultivated.

One other thing noticeable is the lack of mixed farming. The growing of grain in the past has been so profitable, and the work so much more desirable than was the raising of stock, that the latter kind of farming has been neglected. These things will no doubt right themselves in time. The increase in the price of stock has already started many into stock farming, and a few years will see a decided change.

The success of those already in stock farming is sure to have its result.

Besides our regular survey work observations for magnetic declination were taken wherever possible.

APPENDIX No. 46.

REPORT OF N. C. STEWART, D.L.S.

SURVEYS IN THE RAILWAY BELT.

VANCOUVER, B.C., February 10, 1913.

E. DEVILLE, ESQ., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report of my season's operations in the railway belt of the province of British Columbia.

I left Enderby on May 14, 1912, for my first work in township 18, range 7, west of the sixth meridian. The wagon road between Enderby and Mabel lake runs through this township. This road has been widened out and graded during the past season, and is now in good shape, but the soil through which it passes is a heavy clay, which makes it very muddy and sticky after a rain. Owing to the numerous logging operations carried on in this vicinity and on Mabel lake, and to the large number of settlers along Shuswap river, this road is very much used. A branch road, built by the settlers, which leaves the main road about seven miles from Enderby, enabled me to bring my supplies to section 30 with wagons.

I completed the surveys of four sections in the northwest part of the township. A few small benches of good land were found, and the hillsides were covered with grass, making them good for grazing purposes. The soil is a light sandy loam, with a gravel and drift-rock subsoil. The timber has been nearly all burnt off, but a few large fir and bull pine remain. The upper benches in this valley have been cultivated very little, but some good results have been obtained, especially in the raising of vegetables, hay, grain and small fruits. The climate during May and June was all that could be desired, warm days with cool nights but no frost, and only a few days of rain.

I ran two miles of line on the east boundaries of sections 6 and 7 in township 19, range 7, but found only rugged and worthless mountain tops, from which the timber had all been burnt.

On June 4, I moved across Shuswap river to the northwest quarter of section 23, township 18, range 8. A branch road was being built from the Mabel lake road to Trinity valley, a bridge having been erected over Shuswap river on the east boundary of section 22. This road was completed in the fall. The soil along the river is a rich clay loam, which produces hay, grain, vegetables and fruits in abundance. On the benches along Trinity creek a light sandy loam with a gravel subsoil was found. No one has tried to cultivate these benches up to date. The country west of Trinity creek is covered by some marketable timber, but to the east of this creek a bush fire occurred during the previous summer which destroyed most of the timber. Trinity creek has several high waterfalls which might be used for power sites, if the water supply was sufficient in the dry season. More rain falls along Trinity creek than on the north side of Shuswap river.

Game is plentiful in this neighbourhood; black bears, deer and blue and willow grouse were frequently seen.

On June 15 we took the train at Enderby for Field, where we camped in one of the most picturesque spots in the Rockies, on the northern slope of Cathedral mountain, and in direct line with the famous Yoho valley. My work here consisted chiefly in retracements and making ties to the Canadian Pacific railway survey.

The only industry in this part is mining. The Monarch mine is situated on Mt. Stephen, in a very romantic locality. About twenty men were employed, and the mine was said to be paying dividends. The ore is silver-lead.

The old grade of the Canadian Pacific railway has been made into a wagon road, thus affording a means of travel from Field to Hector, and a good road has been constructed from Field up the Yoho valley for the use of tourists. We had excellent weather during our two weeks' stay. We returnedto Moberly on July 1 and commenced regular subdivision work in township 28, range 22, west of the fifth meridian. The soil in this township is a sandy loam, with a clay loam subsoil in many places, which should produce hay, grain, small fruits and vegetables. The land of a similar nature which has been cultivated around Golden produces good crops. A hill between 200 and 300 feet high is found along Columbia river; back of this hill is a more or less rolling bench land which varies from about a mile in width at the south boundary of the township to over five miles at the north. East of this bench rise the rugged slopes of Moberly peak and the mountains to the north of it. Practically all the trees have been burnt, and a thick second growth covers the fallen timber, making travelling and clearing difficult. A road has been built from Golden to Blaeberry river, a distance of nine miles, and a branch road was built by the squatters from Moberly to section 11. A trail from Moberly up Blaeberry river is utilized by the trappers and settlers along that stream. The farmers along Columbia river are very prosperous, mixed farming being found to be the most suitable for this region. The meadows along Columbia river afford a supply of hay for feeding the stock during the long winter. Quite a few trappers still operate in this district, and large game such as bears (black and grizzly), moose, deer, caribou, goats, coyotes and cougar are plentiful; rabbits, grouse and ducks are fairly numerous. Good fishing is to be had at places along Columbia river, especially at the mouths of the clear-water streams from the Selkirks. Much rainy weather was encountered during July and August. A large forest fire occurred in this township and those to the northwest in June, and another large fire destroyed much valuable timber south of Golden. I completed the survey of all land suitable for agriculture in this township east of Columbia river on August 10.

Leaving Beavermouth on August 12, in three heavily loaded canoes, we drifted down to the mouth of Gold river in township 32, range 26, west of the fifth meridian, in about six hours. At the mouth of this river a large flat was found composed of large marshes from which hay could be cut and which were subject to overflow from Columbia and Gold rivers. Around the marshes, large timber, chiefly spruce, was found. Gold river has its source in some of the highest and most picturesque peaks of the Selkirk range, and the melting of the numerous glaciers in these mountains on a hot day causes the water to rise at the rate of about a foot an hour, and the cool nights following cause it to subside almost as rapidly.

On August 28, we moved camp to Bush lake by going up Bush river to the creek and thence to the lake. Here we completed two miles of the belt limit. The country around this lake is all heavily timbered. The land in this township is not very suitable for agricultural purposes, but the wild hay will be valuable when logging operations commence on the numerous timber berths in this territory. The proximity of the glaciers has a bad effect on the climate, and we had very wet weather during our stay on the lake.

Bush lake is at present an ideal spot for a sportsman. There were hundreds of ducks and geese there and its waters were full of rainbow trout. Fur-bearing animals such as beaver, mink, marten, and skunks are plentiful. Two black bears were seen, and the tracks of numerous caribou and goats are to be found on the mountains. Combining this with the fine scenery, the unsurpassed mountains and the ease of canoe travel, I believe one could not find a better place for an outing.

We left Bush lake on September 6, and proceeded up Columbia river to section 17, township 31, range 25, west of the fifth meridian. At two large bends in the river there, I found some land which is suitable for agricultural purposes, although the area of this land is not very great. The soil is a sandy loam with a clay loam subsoil. I examined part of this township to the northeast of Columbia river and though I found no more land suitable for farming, I did find some excellent timber

consisting of large fir, pine, cedar, spruce and balsam. Numerous grouse and ducks were seen, and I might also mention the presence of mosquitoes.

On September 11, with one canoe, I left for Beavermouth, Mr. Johnston following next day with the crew and outfit. We left that place and arrived in Rogers Pass on the 13th.

The survey of the townsite of Rogers Pass was completed on September 21, after which we returned to the Enderby district to complete the surveys there before the snow came. Our work in township 17, range 10, west of the sixth meridian, was reached by wagon from Armstrong. This work was chiefly retracement. The productiveness of the soil in this neighbourhood is shown by the prosperity of the farmers who all have good homes, large barns, fine horses, cattle, sheep, &c. The orchards produce more fruit than can be taken care of, and many acres of potatoes have been left until spring for harvesting owing to an over supply. The growing of celery is becoming a specialty with some of the farmers.

From this township we proceeded by wagon to Deep creek valley where we found a very prosperous community engaged in mixed farming. The land subdivided in township 19, range 9, is all on the west side of the valley. The country had all been burnt over several years ago and a very dense second growth has sprung up. The soil in the bottom lands is a clay loam and on the benches and side-hills it is a sandy loam with numerous rock outcrops. The settlers are very optimistic about the productiveness of the soil in this valley. As the altitude is considerably higher than at Armstrong very little fruit growing has been attempted, however it has been shown that the hardier fruits can be grown. Snow fell on October 19, and all the month was very wet. Willow grouse were very plentiful.

On October 24, I again moved to township 18, range 8, and surveyed the north boundary of section 14, after which we went to township 20, range 8, where we made surveys in sections 15 and 22. A few small benches of fairly good land were found, the soil being of a light sandy loam suitable for growing fruit and vegetables. The fruit farmers in this district are very prosperous.

The towns of Enderby, Armstrong and Salmon Arm are in a flourishing state owing chiefly to the farming and lumbering industries. The prospect of the coming of the Canadian Northern railway into Armstrong has enlivened that town considerably and the completion of the road will no doubt advance the prosperity of the settlers since it will give them another outlet for their produce. The lack of sufficient transportation is at present the principal drawback to this neighbourhood.

We moved again to the vicinity of Golden to traverse part of Columbia river in townships 28 and 29, range 23, west of the fifth meridian. This work was made very easy by the low water. In these townships the Columbia is broken into numerous channels, and the islands are all timbered with spruce, jackpine, balsam and cypress. The large timber was logged off several years ago. The soil on the islands is a sandy loam with a clay loam subsoil and therefore should be suitable for agricultural purposes. I also surveyed some of the bench land in township 29, range 22, and township 29, range 23. This bench is a continuation of the bench land of township 28, range 22, and extends from Blaeberry river to Waitabit creek, a distance of about six miles and averages about one and a half miles in width. The soil is a light sandy loam with a gravel subsoil and should produce good results when cultivated. The timber has all been killed by fire, the most recent fire having been started last spring. Numerous settlers are trying to locate on this land which shows that it appears suitable for farming.

On December 4, I decided to disband the party on account of the depth of the snow and the dangerous condition of the river for canoeing.

I have the honour, to be, Sir,

Your obedient servant,

N. C. STEWART, D.L.S.

APPENDIX No. 47.

REPORT OF P. B. STREET, D.L.S.

SURVEYS IN SOUTHWESTERN ALBERTA.

TORONTO, ONT., January 3, 1913.

E. DEVILLE, ESQ., LL.D.
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following general report of my field work during the season of 1912.

I left High River with my party on May 24, and drove to township 5, range 17, west of the fourth meridian, where my first work lay. This township is open undulating prairie, and is now partly fenced by settlers. Owing to the dry atmosphere which prevails in this district, the settlers have been very unfortunate with their crops up to the present time, and unless they adopt mixed farming their future success will be very uncertain. We retraced all the interior lines of this township and, owing to an error in the west boundary, we were obliged to carry the retracement into the adjoining township to the west.

On completing this work, I moved to township 2, range 19, west of the fourth meridian, and retraced some section lines there. This township, with several others in this vicinity, is held under lease, and an occasional rancher's house is the only sign of settlement. Being situated on Milk river ridge this township is very rough and hilly, and owing to the high altitude it is doubtful if it will be of any use for agriculture, although it is ideal for ranching. We spent only a few days there, and then crossed to Cardston, reaching that town on June 24. I sent the outfit across country through Standoff, Pincher and Cowley, to a camp ground on Oldman river, and went to Lethbridge to get some axemen for the work in the mountains, as I had been short three men since I organized. Finding no suitable men in Lethbridge, I went to Calgary, and secured three men there. I was unable to secure a good packer, which proved a great handicap later as I was forced to train my teamster to do the packing, and this meant that I did most of it myself.

On rejoining my party north of Cowley, we proceeded up the trail from Cowley to the Gap, and from there to McEwen's ranch in section 6, township 12, range 3, west of the fifth meridian. Our trip was delayed several times by bad roads which had to be repaired, and by the rains which came every other day. The land in this district is very rough and broken. A series of ridges run north and south, with narrow valleys between them, affording very little land that could be used for settlement. The wagon road from Cowley runs as far north as section 12 of township 12, range 4, and a pack trail continues from this point up Livingstone river to its head-waters, and over the divide to the head-waters of Highwood river. A railway line was surveyed up this valley, but, as no coal lands of any importance are found along Livingstone river, it is very doubtful if this line will be adopted. We commenced our surveys here on July 3, but we were much delayed by the incessant rains which fell during the early part of that month. Luckily for us the timber in this township, though nearly all fire-killed, was not large, and the men, although unused to the mountains, soon got accustomed to the long walks across country. Creeks are very numerous in this township, and I was much impressed with the abundance of pasture which we found along the creek valleys. The grass grows very rank in the mountains, reaching a height of three or

four feet at the end of the season. If the ranching commission decide to lease the forest reserve, there will be ample pasture for thousands of cattle. A fine crop of timothy hay was raised on McEwen's ranch in section 6 this year, in spite of the bad weather.

On completing the work in this township we moved up the northwest branch of Oldman river, and camped in section 9 near the buildings of the Great West Coal Co. A pack trail from this point follows the river to its head-waters, and is much used by the Indians of the Stony reserve, but like most Indian trails it was made very crooked to avoid as much cutting as possible. I looked over it and decided to abandon it and cut a wagon road up the valley to the west boundary of the township. This was accomplished without much difficulty, and we moved into section 36 of township 12, range 5. We found the country much more mountainous in range 5, and the hills had steeper slopes than we found east of Livingstone river. This country was fire-swept two years ago, and very little green timber can be found now for miles on either side of the river. The country is mostly covered with large windfall, which made walking to and from work very arduous. Considerable bare rock is found on these ridges, black and grey shale and conglomerate being the commoner kinds, and coal outcrops could be seen on the tops of most of the hills and ridges. We saw numerous deer in this locality, but small game such as partridges and rabbits were scarcely seen at all. The fishing was all that could be desired, there being no difficulty in catching a dozen or more any evening after supper.

We moved up Dutch creek early in September, and camped on the creek near the west boundary of township 11, range 4. This country did not suffer very heavily from the big fire two years ago, and large quantities of excellent spruce timber are found in sections 6, 7 and 18 of this township. These areas are all held under timber berths, but no cutting has been attempted up to the present. Dutch creek is too small for driving logs, and a wagon road will have to be built up the creek to enable the owners to get their logs out. We found the windfall in this locality to be the worst we had struck all season, and a great deal of valuable time was lost in walking to and from work. I had anticipated putting in some flying camps in this locality, but the time lost in cutting pack trails would have been too great. We had several snowstorms during September, which delayed the work, and made the chopping disagreeable.

On October 7 we moved up Racehorse creek to the mouth of Daisy creek, there being a wagon road to that point, and a pack trail from there to Lille. A telephone line was strung from Lille to the fire ranger's house, near the mouth of Racehorse creek this season. Our work in this vicinity consisted in surveying some mining claims on the western slope of the Livingstone range, and for the first time during the season we found the country so rough that we were forced to run quarter-section lines instead of the regular section lines. There was about six inches of snow on the hillside, which made climbing difficult and, at times, dangerous.

On completing the work here we moved through the Gap to township 11, range 3, where we surveyed some coal lands. We found this work much more pleasant than our former work as the hills in this locality have much easier slopes and the windfall which bothered us so much in the previous township was entirely absent. The hills are partly open in this township, and partly covered with large fir timber, which, being fire-killed is very hard to cut. A few cattle were being ranged on the hills, but there is an abundance of feed for many more. We finished our work in a few days, and moved up the valley of Callum creek to township 12, range 2. In accordance with your instructions, I examined the east half of this township to see how much of it would be fit for settlement, and decided that the whole eastern half would have to be sub-divided. This township is rather hilly, and partly covered with large fir timber, the fir being confined mostly to the ridges, while the flat or undulating land is mostly open or covered with poplar and willow. The soil is rich, and in spite of the high

altitude, a settler in section 12 managed to raise a good crop of potatoes this year. Small creeks are very numerous, and the pasture on the hills is excellent.

This district is filling up with small ranchers who intend to run their cattle on leases during the summer, and raise feed for their winter keep on their homesteads. The cattle industry has been paralyzed by the sudden disappearance of the big ranches which ranged thousands of cattle every year, but the passing of these ranches is a matter of great satisfaction, as they invariably kept large areas lying idle for winter range, when sufficient winter feed could have been raised on a tenth of these areas had they been cultivated. The new settlers who are now locating in the hills have the right spirit, and as soon as the Government decides the lease question, there will be considerable activity again in the cattle business.

Our work in this locality was constantly interrupted by snowfalls, though the temperature remained unusually high, and the snow disappeared in a few days. Early in December I found that I would be unable to complete all the work allotted in this vicinity, and decided to cease operations as soon as my rations were exhausted. We accordingly broke camp on December 14, and moved back to section 4, township 10, range 2, where I stored the outfit for the winter. On the 16th I drove into Cowley and paid off the men. I completed my business in this locality, and left for High River and Calgary the following day, to look after some details there. I left Calgary on the 19th and reached Toronto on the 23rd.

I have the honour, to be, Sir,

Your obedient servant,

P. B. STREET, D.L.S.

APPENDIX No. 48.

ABSTRACT OF THE REPORT OF A. G. STUART, D.L.S.

RESURVEYS IN MANITOBA.

I arrived at Winnipeg on May 7, and spent the following two days in purchasing an outfit and organizing my party.

My first work for the season was the retracement of the principal meridian beginning at the international boundary. I therefore left Winnipeg on May 10, and travelled southerly over the old trail on the west side of Red river as far as Morris, and thence over well-travelled roads to Gretna.

The country through which we travelled comprises some of the oldest settled parts of the province, and is used almost exclusively for wheat growing. The roads we followed took us through thousands of the finest wheat fields, not only in the West but in the world, and we found the drive a very pleasant one.

In the vicinity west of Morris large areas of low land have recently been drained by the Provincial Government, and in this way large tracts of rich virgin soil have been rendered fit for cultivation.

Practically no homestead lands are available in the vicinity of the meridian south of Winnipeg. The lands in this district, being level or slightly rolling, and composed mostly of rich black loam underlaid with clay, command a value of from twenty-five to fifty dollars per acre. Notwithstanding this fact, each year sees the invasion of many moneyed settlers from the best farming districts of the western States to buy land in this district. Many of these are people whose parents left eastern Canada in the early days at the call of what was then the "greater west." These men, well versed in western ways and methods, are among our best immigrants.

To one accustomed to the ways of Quebec and the Maritime Provinces, the wealth and extensive harvesting methods of this older portion of Manitoba are amazing. The most modern types of farm machinery are seen on every hand, but it is very difficult to get men capable of handling and repairing these machines. The young men of the West are not going in for this kind of work, and the great need at the present time is for a class of skilled artisans and mechanical tradesmen.

After crossing the St. Francois Xavier settlement with the retracement of the meridian, we gradually left the prairie and entered a slightly rolling and more recently settled district, with scattered clumps of scrub and poplar. The settlers go in more for mixed farming, and many large and small dairy farms in the vicinity of Winnipeg supply the demands of the city markets.

A well-travelled road runs northerly close to the meridian for at least one hundred miles, and two lines of railway run northerly as far as the north boundary of township 20, both within ten miles of the meridian, making the daily Winnipeg market easily accessible for farm and dairy produce. Many range cattle are raised in this district. In the small towns along the railways there are many openings for tradesmen and business houses.

Along the meridian in the vicinity of townships 17 and 22 we passed through an extensive Galician colony. These people are fast making homes in the district despite the difficulties with which they have to contend. The country is heavily wooded with poplar, and the ground is covered with loose stone, so that in most instances it has to be cleared of both stone and wood before it is fit for cultivation. Notwithstanding these drawbacks, coupled with a lack of funds, these people are making good homes.

Their children at school are particularly bright, and the parents, through a life of industry and clean living, are developing into Canadian citizens of which the country should be proud.

The cutting and loading of cordwood, consisting of poplar, spruce and tamarack, and marketing it in the cities, gives the settlers a means of making ready money in the slack winter months. In this way, quite an extensive business has grown up along the two lines of railway. In township 19 there are surface indications of fine quarries which will, no doubt, at some later date be developed.

Along the meridian from the source of Icelandic river, in township 22, to the northeast corner of township 28, where my retracement operations ended on September 28, the line continually crosses large and small hay sloughs, which make stock-raising easy and profitable through this district.

A railway is at present under construction as far as Fisher river, and there is still much land open for homesteading which, when cleared of the timber and surface stones, will make first-class mixed-farming land.

Game in this district is fairly plentiful, moose, jumping deer, bears, partridges, prairie chickens and muskrats being found.

There are large areas of excellent grazing land, the hay needing only to be cut and stacked for winter. In lake Winnipeg, near by, large quantities of fish, including whitefish, sturgeon, pickerel, etc., are annually netted for domestic use and for market. Fuel and the best of building material can be obtained practically at one's door.

Notwithstanding these advantages, a homestead, although requiring the investment of only a trifling entry fee, has its conditions not governed by dollars and cents. It requires, as its owner, a man used to hard labour, and when the city clerk, tired of life and with a moving-picture idea of wheat fields and ranching, attempts it, he usually fails. Nevertheless, it is one of the best opportunities in the West to-day.

In the retracement of the meridian we touched on the borders of Indian reserves Nos. 16 and 44. In these reserves the land is good, and to the north, west and east the hunting is excellent. Here moose, elk and caribou are to be found in abundance.

Having finished the retracement of the meridian, the party moved southerly a distance of over sixty miles down the old Oak Point trail to resurvey township 21, range 4, west of the principal meridian. This township is occupied principally by settlers from the peasant districts of old France. These people are engaged principally in mixed farming, and, although commencing in a small way, they are working with an industry and perseverance which will make homes in the near future. The crops in this district, though small in extent, were harvested early, and all were making preparations to cultivate an increased acreage during the coming year.

On November 8 this work was completed, and I drove westerly, striking the old Fairford mail trail at Moosehorn bay, on the east shore of lake Winnipeg. I proceeded to Lower Fairford, where I crossed the river and camped about six miles north between the north limits of Indian reservations Nos. 48 and 50, where my instructions called for the survey of about five miles of road, and the resurvey and tying in of several section lines to these reserve boundaries in townships 31, ranges 8 and 9, west of the principal meridian.

The country immediately north of this work is thickly wooded with poplar. The land, generally speaking, is level, and averages four to six inches of black loam with clay loam subsoil. The extensive grazing lands and hay meadows bordering lake St. Martin make this pre-eminently a stock-raising country. Many excellent homesteads are still available. During the winter months fishing is the main industry, the Indians and the half-breeds making from fifty to two hundred dollars per month on an initial investment of a few nets and a dog train for hauling the fish to the warehouses of the several trading stations along the line of railway.

These reserves are also rich in natural resources. Here, however, the manufacture of many thousands of pairs of moccasins has made the moose and elk much

Photo by C. H. Taggart, D.L.S.
Grand Prairie District in Tp. 13 R. 16, West of the Sixth Meridian.

Photo by H. Matheson, D.L.S.
Fiddle Creek Canyon from the South, Looking down stream.

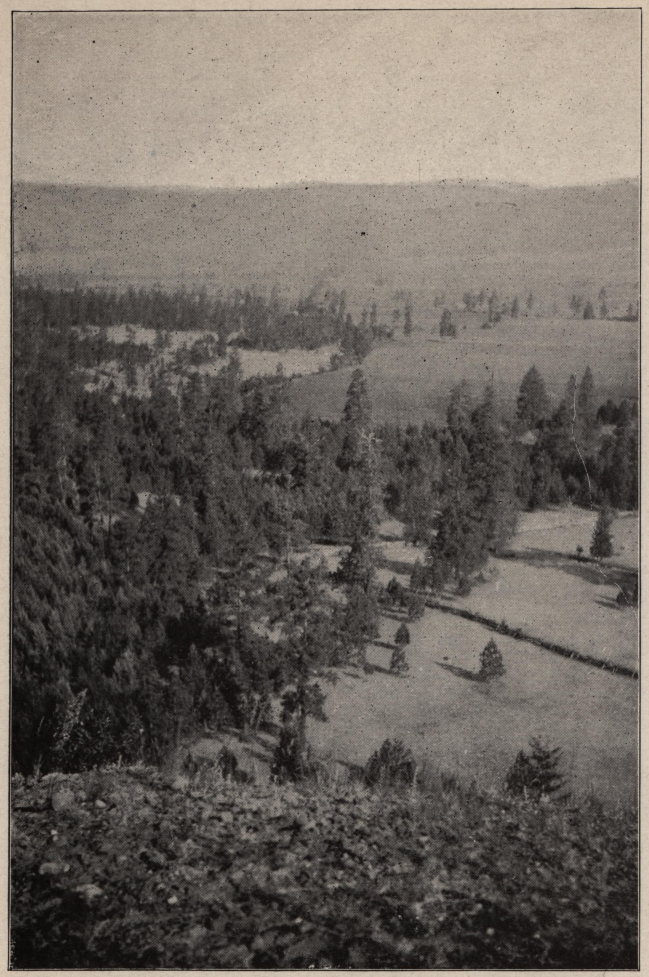

Photo by C. H. Taggart, D.L.S.
Grand Prairie District in Tp. 13 R. 16, West of the Sixth Meridian.

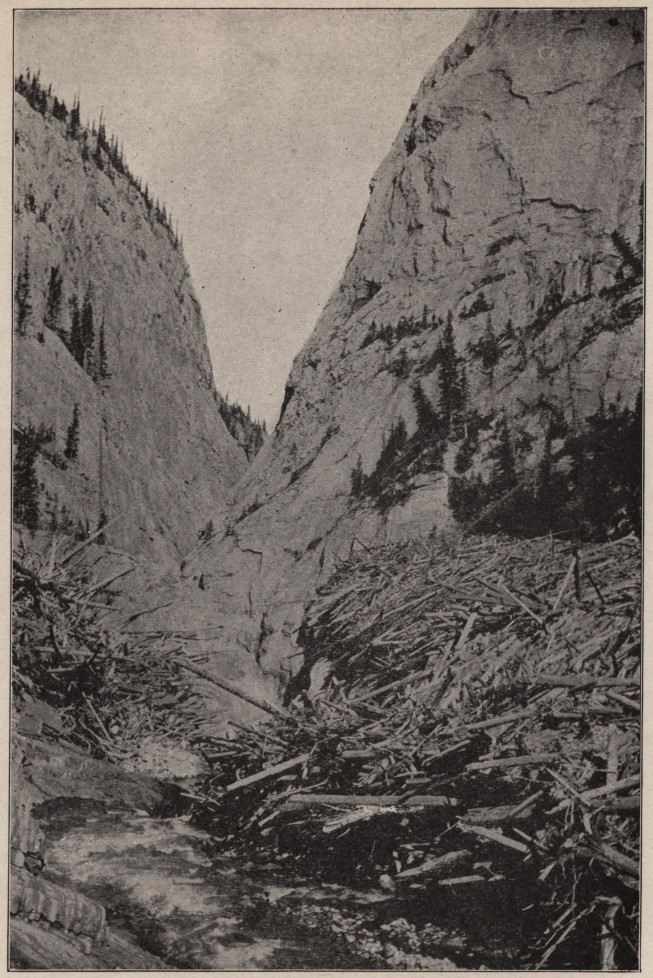

Photo by H. Matheson, D.L.S.
Fiddle Creek Canyon from the South, Looking down stream.

scarcer, in the immediate neighbourhood, than in former years. For the settlers who do not wish to fish during the winter, the cordwood industry and the quarries of the Manitoba Gypsum company give ready employment.

It is most gratifying to note the change for the better coming over the Indians on these reserves. Each family has its house, garden and oxen or horses, and from 6 to 30 head of range cattle. The younger people nearly all read, write and speak both English and an Indian dialect, and often German or French, being excellent linguists. They are also all fond of music. The men all work from four to six months each year, for the trading companies, or are engaged in fishing or on railway location and construction.

This work was completed on November 25, just as the river was fit for crossing. My party was at once discharged and the outfit stored for winter, and with my assistant I proceeded by rail to Eriksdale to retraverse Swan lake, in townships 21, ranges 5 and 6, west of the principal meridian. There is substantial evidence that the water of this lake, which has no visible outlet, has lowered at least six feet during the past twenty years. In the vicinity the homesteads have all been taken up and the settlers are making remarkable progress in mixed farming, with Winnipieg as a market. The land is excellent, and wild hay plentiful. Here again the cordwood industry is in evidence during the winter.

The traverse of the main lake was completed about December 21, and I returned to Winnipeg to prepare office returns for a couple of weeks before joining Mr. Rolfson as assistant on northern surveys.

APPENDIX No. 49.

REPORT OF C. H. TAGGART, D.L.S.

SURVEYS IN THE KAMLOOPS DISTRICT OF THE RAILWAY BELT, B.C.

OTTAWA, ONT., February 26, 1913.

E. DEVILLE, LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following general report of my survey operations in the Kamloops district, in the railway belt, British Columbia, for the season 1912.

As soon as possible after the receipt of my instructions, I left for Kamloops, the point of organization, arriving there on Sunday, April 28.

Kamloops is a flourishing town of about 5,000 inhabitants, beautifully situated at the confluence of the North and South Thompson rivers, and is termed the 'Inland capital of British Columbia.' The surrounding country is known as the 'dry belt,' owing to the small amount of precipitation. Its elevation is 1,160 feet above sea-level, and the climate is very dry and invigorating, making it a pre-eminently desirable resort, especially for those suffering from pulmonary troubles.

The city had its start around a Hudson's Bay company's post, about one hundred years ago, and during the past summer celebrated its centenary in a most fitting manner. Many demonstrations of the old days were seen, which, when compared with to-day, show the development. This place is a divisional point for the Canadian Pacific railway, and in the near future the Canadian Northern Pacific railway line will be in operation, when it is expected that besides being a divisional point for this road, large railway shops will be erected, which will be a great boon to the city. The latter company also intend building a branch line, starting from Kamloops, to penetrate the rich and fertile Okanagan valley. The survey for it was made during the past summer.

The country around Kamloops is generally mountainous, with fertile valleys. The principal crop grown is hay and grain, which is used as feed for the great numbers of cattle and horses for which the district is noted. This industry is to some extent on the decline, and many of the larger ranches are being divided into small holdings, and extensive irrigation systems installed, for the exclusive growing of fruit.

Two fine bridges cross Thompson river; the one to the west of the town gives access to the country west of North Thompson river, and the one to the east joins the city to roads leading into the country east of the river.

The organization of my party was completed on the night of April 30, and on the morning of May 1, I left Kamloops for my first work, the subdivision of the unsurveyed portion of township 21, range 17, west of the sixth meridian, lying east of North Thompson river, and north and adjacent to the Kamloops Indian reserve.

Leaving Kamloops by the new east-end bridge, we entered the reservation for the Kamloops Indians. This large reserve, which extends easterly along South Thompson river for seven or eight miles and northerly along North Thompson river for the same distance, contains a large area of the best agricultural land in the district. Unlike many patches of good land which are of little value, this area has, in Paul creek, an abundance of good water available for irrigation purposes. The striking feature is that very little of the water or the land is being made any use of

by the Indians, whereas if the same were in the hands of thrifty ranchers great crops would be raised. Here also is to be found some fine grazing land.

The Government wagon and automobile road crosses the Indian reserve boundary into township 21, range 17, close to the river bank, whence it follows the foot of the hills. Between the river and the road is to be seen the new grade of the Canadian Northern Pacific railway, and bordering this are some fine ranches. The first of these is the Longburn ranch, owned by W. R. Austin. This ranch is of considerable size and produces fine crops of hay, grain and fruit.

The greater part of the land subdivided in this township is about fifteen hundred feet above Thompson river. The lands comprising the southwest quarter of section 36, the north half of section 26, the north half and the southwest quarter of section 27, and the southeast quarter of section 28, lie on the lower slope of the rise which forms the remainder of this township. This land is best suited for irrigation purposes in connection with some of the large ranches lying along North Thompson river. The water if brought down from Heffley lakes in township 22, range 16, could be kept well up on the slope at sufficient elevation for distribution over any of the lands on the east side of the river in sections 33, 28, 21 and 20 of township 21, range 17.

The remainder of the land is mostly open, or openly timbered, and has previously been used as range land, for which it is well suited. If sufficient water for irrigation were procurable, some portions of this land would be productive of good crops, but this essential is lacking. However, it is quite possible that the dry farming method would be successful.

In travelling along the road to our next work, in township 22, range 17, the first place of interest was the Anderson ranch, which is a very extensive one producing fine crops of hay, grain, vegetables and small fruit, and raising many head of cattle and horses. I understand that on both the Longburn and Anderson ranches extensive plans are being made for irrigation systems to bring water from Heffley lakes.

Next we passed the Edwards ranch, belonging to Mr. W. R. Austin. The chief product of this ranch is hay and grain, of which excellent crops were seen; vegetables and small fruits are also grown. The ranch is very large and extends to Heffley creek, the waters of which are carried by a system of good ditches and distributed over the land. On this ranch, near the confluence of Heffley creek and North Thompson river, and along the wagon road is to be found a first-class general store, post-office, hall, church and temperance hotel, all the property of Mr. Austin. Here our second camp was erected.

Last October, at Heffley Creek village a fall fair was held in which great interest was manifested. Products of the lands on North Thompson river and its tributaries were exhibited, and an excellent showing was made, which demonstrates the great possibilities of the district.

The land surveyed in this township is mostly rough and rolling and is timbered with fir and pine. In years past cattle have ranged over it, for which purpose it is best adapted. There are some small patches of land which, with irrigation, would be quite productive of hay, grain and perhaps small fruit. Irrigation might be possible by the construction of a long ditch leading from Heffley creek two or three miles farther up stream, but this is impracticable, as the cost would be too great for the amount of land to be watered.

North Thompson river flows through one of the principal valleys of the district, and extends for 200 miles northward, having extensive fertile areas along its banks for a considerable distance, and at present a good wagon and automobile road traverses it. In the near future, however, the Canadian Northern Pacific railway, which is now being rapidly rushed to completion, will be in operation, and will do much to develop the large country it passes through.

Our next work took us along Heffley creek to its source, the Heffley lakes, where subdivision of lands suitable for agriculture in township 22, range 16, was made.

These lands are at a considerable elevation, but judging from the excellent showing of the other ranches along Heffley and Edwards creeks, good crops of hay should be possible. In sections 9 and 22 splendid crops of hay and grain were seen, while vegetables of high order are grown. Some good range land is also to be found.

Heffley creek is a stream from fifteen to twenty-five feet in width and from six inches to two feet deep. It takes its rise in a lake of the same name, at an elevation of about 3,300 feet, and in its descent to North Thompson river falls at the rate of about 200 feet to the mile. It has a maximum flow of about 100 second-feet. Heffley lake is about two miles in length and several hundred yards wide. It affords an excellent storage reservoir for the freshet waters. The water users have co-operated in building a small dam at the lake outlet, but this is quite inadequate; the storage capacity of the lake could be greatly increased, and no water need be wasted. I made some rough measurements, and from these it appears that the lake water could be raised from two and a half to three feet above the present dam without seriously affecting any other interests. It is probable that on the upper reaches of the creek and at Heffley lake the precipitation is about twenty-five inches. The rainfall at the mouth is between eight and twelve inches, with a very light snowfall.

Heffley creek, like most of the streams in the dry belt, is vastly over recorded, but at the same time, with judicious handling there is enough water for all users. The storage, as has been pointed out, is not at its highest efficiency, and the methods used by most of the irrigators are very primitive. Much water is lost through seepage, and this could be obviated by individual irrigation works.

The most tedious and arduous piece of work of the season was the delimitation of the boundary of the railway belt across townships 23 and 24, range 15, and township 24, range 14. In most places this boundary runs over rough mountainous country, thickly wooded, and in some places the ground was covered with a thick layer of windfall. This is bad at any time, but at the time of survey, when much rain fell, it was very slippery which made the travelling extra difficult.

Crossing the summit of the high range of mountains from Edwards creek and Kenuff lake valley, a steep descent leads down to the Louis creek valley about twenty-two hundred feet below. This valley is of an average width of about three-quarters of a mile, and in it some fine bottom land is to be found along Louis creek, with some good benches lying nearer the mountains. Nearly all this land has been taken up, and good crops of hay, grain and small fruit are raised. The raising of fruit has not as yet been gone into to any extent, but from the results of some of the small patches seen it is evident that the growing of the small varieties would be very successful. A great drawback to the rapid development of the fruit-growing industry is the distance from any market. The ranchers, here, therefore, produce such crops as can be fed to cattle, sheep, etc.

The main tributaries to Louis creek are McGillivray and Cahilty creeks. On McGillivray creek a small saw-mill is in operation, the water of the creek being used for power. It is possible that a much larger power could be developed.

Cahilty creek, the main tributary of Louis creek, is a torrential mountain stream rising in the highest hills of the Louis creek drainage area, and discharging into Louis creek at an elevation of about 2,000 feet; its waters are used during the summer months for irrigation purposes. The supply is more than enough for all possible users, its maximum flow being about 400 second-feet. The water could be used to good advantage for power. Cahilty lake, about six miles from the mouth, affords excellent storage for the spring freshet. A narrow canyon through which the creek flows at the outlet of the lake could easily be dammed and a mean flow of from 25 to 35 second-feet procured.

I am indebted to the Hydrographic Survey department, under the supervision of Mr. P. A. Carson, D.L.S., for the information regarding flow and record of Heffley and Cahilty creeks.

In conjunction with the survey of the limit of the railway belt, all lands suitable for settlement in the valleys of Fadear and Cicero creeks, in township 24, range 15, and townships 23 and 24, range 14, were surveyed.

The completion of the survey of the belt limit brought us down to the Adams lake valley, about three and a half miles from the landing on Agate bay. Lying along Pass creek some good agricultural land is to be found. Squatters are located on most of it, but they cannot get entry, owing to the fact that all the unoccupied land within the railway belt in this valley is a timber berth. In this valley, in section 1, township 25, range 14, a small survey was made to tie in the Homestake group of mineral claims. These claims are not in operation, for the reason that the copper ore is not of sufficiently high quality to warrant the excessive cost of transportation to the railway.

A good wagon road has recently been constructed, branching off the Louis creek road at Blucher Hall post-office, and after following the Adams lake valley, terminates at the landing on Agate bay. Good crops of hay and grain were seen, and the yield of potatoes, etc., was fine.

Our next work was in what is known as the Back valley, township 20, range 15, and to reach it we were obliged to return to Kamloops, where we arrived at noon on October 23. After stocking up with supplies and getting the outfit in condition for winter weather, we left Kamloops at noon on the following day, taking the wagon road following South Thompson river for five or six miles to where it branches, leading into the Harper ranch. This is an old and extensive ranch, and is considered one of the best in the district. The land is very productive of hay, grain and vegetables, and a considerable amount of fruit of good quality was seen. At one time as many as three thousand head of cattle were handled on this ranch, but to-day from nine hundred to one thousand is the greatest number that can be successfully cared for, owing to the fact that the range land is being more and more cut off as the country is settled, and is not as productive of bunch grass, owing to many years of grazing, and also during the past few years the winter seasons have been more severe and the snowfall greater, necessitating the feeding of the stock for a much longer period. An average of about one ton of fodder per head is required to winter stock successfully. In the winter of 1911-12 feeding had to be started in November, whereas in an ordinary year previously, feeding was seldom started before January 1, and sometimes not before the 15th.

These statements may also be applied to the whole district.

From the Harper ranch to Pinantan lake the road rises rapidly and crosses the high range of hills forming the north limit of the South Thompson valley. On the north shore of Pinantan lake the first ranch in the Back valley is seen, and following this lake easterly, and along Paul creek, numerous ranches are located. Good crops of hay and grain were seen, for the maturing of which no irrigation was used.

A much better route for reaching this valley is now available. A new wagon road which has been completed this winter branches off the North river road at the crossing of Paul creek, and following the creek passes close to Paul lake and enters township 20, range 15 in section 31. The road then follows along the creek from the lake to near the west end of Pinantan lake, where it connects with the old road. This route is preferable, as there are no steep grades like those on the old road.

The work in this township consisted in the establishment of the north boundary of the township as far as the northeast corner of section 31, and running the meridional section lines to monuments established by previous surveys. The lands surveyed are mostly high and rolling, openly timbered with fir and pine, and a thick growth of underbrush. They cannot be said to be farming lands, although some small patches of good land are to be found. The district is best suited for ranching. North of the north boundary of this township is the Niskonlith forest reserve.

Having completed the survey in township 20, range 15, we moved camp to Trapp lake, township 17, range 17, where we arrived on November 9, and proceeded to subdivide a tract of range land in the eastern portion of the township. We also traversed

Trapp lake, and resurveyed fishing stations numbers two and three for the Kamloops Indians. The land subdivided is mostly open and rolling, and ordinarily is not productive of any kind of crop, owing to the lack of water. In my report of 1911 can be found a detailed report of this valley.

Having completed work in this township on November 20, we moved to township 18, range 18, where a portion of the township lying east of the Long Lake forest reserve was subdivided. This was completed on December 15, and on the following day we again arrived in Kamloops, where we took train for Chase, a small thriving town, situated on the Canadian Pacific railway, at the outlet of Little Shuswap lake in township 21, range 13, west of the sixth meridian.

This town possesses a large saw-mill, fitted with the most modern machinery, and operated by the Adams River Lumber Co., and on all sides can be seen the results of a progressive lumber industry. There is also a splendidly-appointed hotel which is not surpassed in towns many times the size of this one. During the summer months many tourists and commercial men make it a point to arrive in Chase to spend Sunday. Boating and excellent fishing are to be had on the lake.

My instructions called for the establishment of the east boundaries of section 25 and the south half of section 36, and the north boundary of section 25. This work proved to be difficult, owing to the fact that the lines ran over a very steep rocky mountain, which was blanketed with snow several inches deep, making it slippery and dangerous.

Having completed this piece of work I decided to suspend operations owing to the lateness of the season and the coming of severe weather. I accordingly returned to Kamloops on Saturday, December 21, paid off the party, and on the 23rd stored the outfit for the winter. On the 26th, having closed up all business in connection with the season's operations, I left for Ottawa, where I arrived on December 31.

The weather conditions throughout the season were much out of the ordinary, and most unfavourable for survey operations owing to excessive rains during the months of June, July, August and September. No real warm weather was experienced. At the outset of the season things looked very bright for the farmer, especially those who are not so fortunate as to have plenty of water for irrigation. Good crops could easily be raised on any of the land, which in an ordinary year would be baked and cracked from lack of water and from the extreme warm weather, making growth impossible. When the crops of hay and grain, which were excellent throughout the district, were ready for harvest and the rains continued, great disappointment was felt, and tons of hay and grain were ruined before it was got into the stack.

In speaking with one man, who has been ranching in the district for the past forty years, he said:—

> 'Had any one asked me some years ago if we would ever receive too much rain in the dry belt, I would have said, emphatically, "No," but I will admit I would have been wrong, for this year we have had far too much. If in every year we were to receive but half the amount that fell this summer, all the bottom and bench lands would produce good crops, and without irrigation. I have put in a crop on my ranch annually for the past thirty-seven years, and have never seen as much rain. The climate is certainly changing.'

Two heavy cloud bursts were experienced during the summer, and many heavy thunderstorms. During one of these, which occurred after all hands had rolled in for the night, we were awakened by the falling of a thirty-inch fir tree, which fell parallel to three tents in which five men were asleep; had it come but ten feet to the right all five certainly would have been killed.

I have the honour, to be, Sir,

Your obedient servant,

C. H. TAGGART, D.L.S.

APPENDIX No. 50.

ABSTRACT OF THE REPORT OF C. M. WALKER, D.L.S.,

MISCELLANEOUS SURVEYS IN SOUTHERN ALBERTA.

According to instructions, I procured my outfit at Calgary and, having shipped it to Medicine Hat, I took the trail there leading to township 2, range 6, west of the fourth meridian where my first work lay.

During the summer and fall of 1911, this old trail running south from Medicine Hat, was surveyed and graded to some extent, an effort being made to follow the regular road allowance where at all possible. Naturally, many steep grades resulted, so that in wet weather the present road is almost impassable with any load. At the present time this is somewhat of a hardship for the settlers to the south, many of whom are compelled to haul their grain, produce and supplies over this road for sixty or seventy miles. However, when grading is completed and culverts and bridges put into proper shape, a fairly good and direct highway will result.

Arriving in township 2, we immediately proceeded with the retracement survey.

As a general thing, the mounds of the previous survey were found on the ground in a more or less obliterated condition and, in every case, were renewed, but many of the original iron posts were missing.

The greater part of this township is gently rolling prairie, quite suitable for mixed farming,. Those sections, however, adjoining Milk river, namely sections 18, 7, 8, 5, 4, the south-west quarters of sections 9 and 3 and portions of the southern half of sections 2 and 1, are of little use. Several sections in the northeastern portion of the township, namely, sections 25, 35 and 36, and the eastern half of 34, are also so much cut up by bad lands as to be of little value for farming.

Practically all of the available land in this township has been taken up either as homesteads or pre-emptions.

During June of 1912 the crops appeared to be in splendid condition and gave promise of an abundant harvest. In the preceding two years, however, the crops were failures, due to drought and early frosts.

Large areas of land were under cultivation in this district, this season, the different grains being wheat, oats and flax. Of these three, flax appears to be the best adapted to local conditions.

The climate is not at all suitable for corn, even as green feed, but, on the other hand, small vegetables of an exceptionally good quality and of considerable variety are grown. Potatoes especially do exceedingly well. At present, on account of the long haul to market, small vegetables are raised purely for home consumption, but in the event of a railroad being constructed through the immediate neighbourhood, and several are proposed at present, market gardening should prove to be a very lucrative business.

The homesteaders in township 2 are principally Swedish Americans, many of them having proved up, and advantageously sold their homesteads in the western States before coming to this country. Consequently the buildings in the neighbourhood are of a somewhat better class than is usually found on the average homestead.

Mixed farming is carried on to some extent, the stock being of medium quality; all the range land being taken up under lease, the amount of stock for the individual settler is limited to his own homestead and pre-emption.

A post-office, on section 10, and a school on section 15, have been opened up recently and prove great conveniences to the homesteaders of the township.

The soil is a good variety of clay to clay loam, though in the near vicinity of Milk river valley much sandy loam and sandstone rock appear on or near the surface.

Sloughs are to be found in different parts of the township, which provide water and a fair amount of slough grass for stock. A number of the settlers have obtained good and abundant supplies of water by sinking wells from fifty to sixty feet, while others use water from surface wells placed in the vicinity of sloughs.

Very little alkali is in evidence anywhere in the township, with the exception of the bad lands previously referred to.

Township 1, range 6, is of a similar nature to township 3. It is of a gently rolling nature, the exception being that portion included in the Milk river canyon, which cuts off most of the northeastern part of the township.

The soil in this township is not of so good a quality as that of township 2, being of a harder nature, with considerable alkali in evidence.

The whole township is under lease as range land, which is the only thing it is suitable for, and consequently no settlements of any kind have been made therein.

In addition to Milk river, which traverses township 1, a small stream known as Kennedy creek is to be found flowing southeast from the central portion of the township. By allowing the water from this creek, which is more or less alkaline, to seep through into wells placed near at hand, drinking water is obtained.

The township affords a fair range for stock, with a constant water supply in Milk river and Kennedy creek. It appears, however, to be suited for no other purpose.

Though Milk river itself at this point is an insignificant stream, its valley attains huge proportions. The river flows sluggishly along the bottom of a valley, some four hundred feet below the prairie level, and varies from fifty to two hundred feet in width, ordinarily. On the other hand, the sides of the valley are from one to four miles apart. These sides are composed chiefly of bare clay banks with, here and there, projections of sandstone. Huge clay buttes are much in evidence, along the valley, often running up to the prairie level, then dipping down to the level of the river again. These bad lands extend from one to two miles back from the river on either side, thus rendering a considerable portion of the country useless.

Along Milk river valley, a considerable quantity of cottonwood is to be found, both large and small. The latter provides for fence posts, &c., needed by the settlers. The larger trees are of no value, since the labour of getting them out of the valley is excessive, packing being the only available method.

Along the sides of the valley, many seams of coal are to be seen. These seams appear to lie in planes parallel to the prairie level and extend along the sides of the valley for miles. The layers vary in thickness from three to ten feet and, when the outside surface has been removed, the result is a fair sample of lignitic coal, which makes a hot fire and leaves little shale, though much ash. This coal proves to be a convenient and cheap fuel for the needy homesteader.

Having completed the required surveys in townships 2 and 1, range 6, we drove back to Medicine Hat and shipped our outfit to Banff, where our next work lay.

Our first work there consisted in locating a cemetery and in running traverses for the determination of other land suitable for the extension of the town plot, to the south and east.

An investigation survey was then made to ascertain what surveys had really been made in the villa lot section, years ago. As a number of buildings had been erected in this section, they had to be located on the ground. Traverses of all the roads in this part of the town, along which buildings or improvements were found, were made and portions of those ranges in which improvements were found were then posted, by means of information obtained from these traverses.

Intermittently with this work, we were engaged on a retracement survey of the Banff town plot, this survey calling for the posting of all corners of all lots in the plot.

Photo by E. Deville, D.T.S.

Columbia River at Revelstoke.

Photo by E. Deville, D T.S.

Shuswap Lake at Sicamous.

Due to the absence of governing posts in some of the blocks, a number of buildings have been erected over the street line or over lot lines.

In the case of blocks, with curvilinear boundaries, no posts or marks were to be found on curved portions to indicate in any way that a previous survey had been made.

Additions were made to the town plot, comprising eight new blocks, namely Nos. 28, 29, 30, 31, 32, 33, 34 and 35.

Of these extension blocks, the two most desirable are Nos. 34 and 35, both of which contain some very choice lots which are very convenient to the main portion of the town.

Having completed the town plot and extensions as described, my next instructions called for a traverse and levels over all the roads and paths for a distance of six miles out of Banff.

In doing this work, the following roads and paths were traversed and levels were taken along the centre of the roads at 100-foot stations:—

Road to Sundance canyon.
Spray River road.
Loop drive.
Corkscrew drive.
Anthracite road to Anthracite and return.
Lake Minnewanka road to Vermilion Lake road.
Mountain avenue.
Sulphur Mountain bridle path to top of Sulphur mountain and observatory.
Tunnel Mountain bridle path to top.
In the case of the last two roads, vertical angles were read instead of levels.

Having completed the work for which I had instructions, I disbanded the party on December 15.

APPENDIX No. 51

REPORT OF J. N. WALLACE, D.L.S.

LEVELLING ALONG BASE AND MERIDIAN LINES IN SASKATCHEWAN AND ALBERTA.

CALGARY, ALTA., March 31, 1913.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report on levelling operations during the season ended March 31, 1913.

In regard to level work done along the meridian and base lines surveyed last season, considerable progress has been made not only in a large additional mileage of levels, but in improved field work, and in the methods followed in recording the level notes and arranging the results. As the system of levels is necessarily built up from the south to the north, the new lines run each year are wholly dependent for their datum on the lines which were run farther south in previous years. The base lines being the pioneer lines of the whole system of survey, their very nature necessitates that the levels taken along them, while they are being surveyed, must be dependent on themselves. In the country where these lines are being surveyed there is, in fact, practically no other feasible route for running independent lines of levels. Occasionally a line can be run over the ice of some large river in winter, and such have been already utilized. Railway lines, which are the routes universally used to run long lines of levels in settled country, do not exist where base lines are being surveyed. The railways follow comparatively far in the rear, and such has always been the case.

It is necessary, therefore that as great accuracy as the field conditions of an unsettled district will allow be aimed at in these levels along base lines, and further that, as opportunities arising from new railways or other causes occur, these should be utilized to run independent lines of precise levels which, running north and crossing former base lines, even though at widely separated points, will cancel the accumulation of errors in the base lines. By this means, while a certain considerable distance must always intervene between new base lines and the nearest precise elevation, and while from the nature of the case, these new base lines must carry a heritage of error from the intervening base lines, yet if the lines of precise levels are extended continually north, even though always in the rear, this heritage of error will not increase, but will be cut out in the southerly base lines as quickly as it increases in the northerly ones.

As may readily be understood by consideration of the circumstances, the levels run along base lines afford the very first information of elevations of the various features of the country. These levels suddenly change a condition of affairs in which elevations were wholly unknown to a condition where they are known with a high degree of accuracy. The lines of levels are themselves always run twice, each mile being run in opposite directions, and if these duplicates do not agree within 0·10 feet to a mile, the mile must be levelled over again. In practice, this limit is never exceeded, and the duplicate lines very seldom show even this discrepancy.

The additional mileage of levels run along meridians and base lines in the year ended March 31, 1913, is as follows:—

	Miles.
Along and west of the principal meridian	597
" " second "	156
" " third "	156
" " fourth "	282
" " fifth "	156
" " sixth "	144
	1,491
Run in previous years.	2,913
Total.	4,404

Three thousand three hundred and forty miles of this total of 4,404 miles has already been connected either to sea-level datum or to some railway datum closely approximating sea-level, while the remaining 1,064 miles have not yet been connected to any known datum. Of this unconnected mileage of levels, about 250 miles are situated in a district extending 50 to 100 miles northwest of Edson on the Grand Trunk Pacific railway, which is the nearest present railway point; about 100 miles are along three short base lines near the foot-hills of the Rocky mountains, 100 miles northwest of Calgary, and the greater part of the remainder is in the district north and west of lake Winnipeg.

The 3,340 miles of levels which have already been connected to a known datum are spread over a country extending from eastern Manitoba to western Alberta. To give some idea of the extent of the country through which they run, it may be mentioned that, using the water of lake Winnipeg for a connection of 60 miles, there exists a continuous line of levels from the intersection of the principal meridian and the international boundary, in southern Manitoba, to the extreme northwest of Peace River block, a length of 1,520 miles, every mile of which, except about 50 miles along one railway in Manitoba, has been run along some meridian or base line, and the northwesterly end of this connection is over 400 miles in advance of any railway.

The longest line of levels in one absolutely straight line occurs on the fourth meridian, along which continuous levels have been run from township 60, south of Cold lake, to township 115, on the south shore of Athabaska lake, a distance of 330 miles.

Apart from the levels along meridian and base lines, but connected with the same system, the following lines of levels were run during the past year:—

	Miles.
(1) From Athabaska Landing to the crossing of the fifth meridian, along Athabaska river	70
(2) From Edmonton to Athabaska Landing, the southerly part along the travelled highway, the northerly part along the Canadian Northern railway	95
(3) From Prince Albert to Hudson Bay Junction, along the Canadian Northern railway	162
(4) From Warman to Islay, along the Canadian Northern railway	193
(5) From Prince Albert to Warman, along the Canadian Northern railway	73

The total length of all these is 592 miles. They may be described as forming a line from Hudson Bay Junction via Prince Albert, Warman, Edmonton and Athabaska Landing to the fifth meridian where it crosses Athabaska river, except a gap of 145 miles between Islay and Edmonton.

These lines, except the first, are all run as precise lines of levels, the instruments used being a precise level of the United States Coast and Geodetic survey pattern

and precise rods graduated into yards, tenths and hundredths of yards. The graduation of the rods is practically of the same pattern as used on precise meter rods. The smallest graduation on the rod is one-hundredth of a yard, the readings being estimated to thousandths. Three wires were read, as usual, the sum giving differences of elevation in feet. The readings of the three wires at each sight were read over again if the difference between the wire intervals exceeds three-thousandths of a yard.

All lines were run independently in both a forward and backward direction. The limit which was set is expressed by the formula:—

$$0.017 \text{ feet} \times \sqrt{\text{number of miles}}$$

and unless the duplicate of a mile section agreed within this amount, the section was levelled over again.

The use of a railway handcar was allowed by the Canadian Northern railway, and one was used in all cases. The level party consisted of the leveller, recorder, two rodmen, umbrella man, cook and a man appointed by the railway to watch the handcar, and one man to make bench-marks. The party camped in tents on all the lines. Subsequent experience shows, however, that it is often more economical to board the party at the hotels if there are sufficient small towns. The reason of this is almost entirely due to the expense of a cook for a small party. A cook requires the same wages to cook for one man or a dozen, and allowing for his wages and board the cost of a cook for a party of six men practically amounts to fifty cents per man per day.

In many cases, however, there were long stretches of line with no hotel, necessitating a camp and a cook. In the case of the line from Prince Albert to Hudson Bay Junction there was no town whatever between Tisdale and the Junction, a distance of 73 miles, although there were several lumber camps which, however, were not suitable for the survey party.

The chief trouble about dispensing with a camp and cook is where gaps occur between towns which are too far apart to allow the work to be carried to the middle from each end. One or two such gaps, even though exceptional, would cause serious inconvenience without a camp.

A great trouble on some of the lines was the infrequency of trains, and the number of stopping places where there was no railway agent, and hence no means of knowing when a freight train would pass which could be utilized to move camp. Especially on the Hudson Bay Junction line freight trains were few and far between, and an experience of three months failed to discover any rule by which the arrival of a freight train could be foretold, where there was no agent.

After many efforts to solve the puzzle of the time of arrival of a freight had failed, reliance had to be placed on moving the camp outfit in the baggage car of the daily passenger train. This not only resulted in trying the conductor's temper at the delay but, as the work got farther east, the time of arrival of the train got later each move, until, near the end of the season, it was long after dark when the passenger train picked up the camp outfit, and darker still when it deposited it at some flag station with no accommodation for the party until the tents were pitched. It would be a mistake to suppose that such lines of levels have no transport difficulties.

The matter of permanent bench-marks in a district where there are no structures of stone or concrete is best arranged by establishing special ones. These were made by building a small concrete pillar. A hole about a foot and a half in diameter and 6 feet deep is dug with a crowbar and a shovel with an 8 foot handle, known as a spoon. A footing of concrete having been placed in the bottom of the hole, a hollow box made of four planks, 1 foot square at the base and 7 inches square at the top, is then placed on the footing and the box is filled with concrete. A brass plate with a shank attached is sunk in the top of the pillar and the elevation of this recorded after the pillar has been filled in and had a week or so to settle and become firm. Such

a concrete pillar is much the best kind of bench-mark in the absence of a substantial bridge or building, but the size used is somewhat small, and in the latter part of the season a larger size was made. It was frequently very difficult to get sand and gravel. During the season, 77 such pillars were made.

In addition to establishing the permanent bench-marks at every station and, in many cases midway between stations, temporary bench-marks were left at the end of every mile. These consisted of railway spikes eight inches long and half an inch square driven into telegraph poles. They were established chiefly as temporary marks for checking each day's work but, although not really stable, yet in the case of poles situated on locally high ground where there is not much moisture in the soil to cause heaving by frost, they have a decided value as a future reference, where precision is not required.

The only intermediate sights recorded were the elevations of the base of rail at each railway station, but in the future it is intended to record the elevations of all important features crossed, such as streams.

The following is a short description of each of the several lines of levels which were run:—

1. *Athabaska Landing to the fifth meridian, 70miles.*—This line was necessarily levelled in winter. It was run by Mr. de la Condamine between February 5 and March 6, 1912. The bench-marks are marks left on the various stopping-houses, easily found but not of a very permanent character. It is intended to replace them by more permanent marks. The party consisted of a leveller, two rodmen, a cook and a teamster with one team. Camp was moved with the aid of passing freighters. The line of levels was commenced at a Canadian Northern railway bench-mark at Athabaska Landing and ended on the bench-marks at the southerly end of the fifth meridian levels. These last were run in the year 1911 along this meridian from Athabaska river to Peace river, a distance of 315 miles.

The line up the river from Athabaska Landing at present forms the only connection which supplies a known datum for all levels in the Peace River district.

2. *Edmonton to Athabaska Landing, 95 miles.*—This was commenced on May 3 and ended July 23.

It follows the travelled highway for 61 miles northerly from Edmonton, and then follows the Canadian Northern railway, which at that time was constructed but not open for traffic. Owing to the rough surface of the southerly part of the route, progress was much slower than is the case where running a line of levels along a railway. Bench-marks were left at a distance of three to four miles apart. They consist of three-inch galvanized iron pipes sunk in concrete foundations four feet below the surface, the top of the cap of the pipe in each case appearing ten inches above ground and being the recorded elevation.

The probable error of the mean of a mile section, as computed from the discrepancies between the forward and backward lines of each individual section is 0.0040 feet. The total discrepancy for the whole line is 0.104 feet.

3. *Prince Albert to Hudson Bay Junction, 162 miles.*—This line was commenced on August 2 and completed on October 17. Between Prince Albert and Tisdale the Canadian Northern railway, over which the line of levels was run, passes through a partly open country. From Tisdale to the end of the line the country is thickly timbered, affording shelter from wind, a very important consideration. The line of levels was run by Mr. de la Condamine from Prince Albert to Star City (76 miles), which he reached on September 6. On that date he left camp to measure a precise base line with the invar apparatus at Salmon Arm, B.C. This base, which is 5.1 miles long, was measured in connection with the triangulation of the railway belt, and occupied Mr. de la Condamine till the end of the season. When he left I continued the line of levels for the remaining 86 miles to Hudson Bay Junction, reaching there on October 17.

Permanent bench-marks, consisting of concrete pillars, have been established close to every station named in the railway time table, whether the district is settled or not and, in addition, many such pillars have been placed midway between stations, and frequent marks have been left on trestle bridges.

This line of levels shows the smallest probable error, for a mile section, of any line run this past season, being 0.0030 feet for the 86 miles I levelled, and 0.0033 feet for the 76 miles levelled by Mr. de la Condamine. The time taken was 76 days from the day of commencement to the day of ending. This is at the rate of 64 miles per month. The average run of a fair day was seven to eight miles of single line. Conditions of transport caused a good deal of delay. On the other hand, few days were lost owing to high winds, as the line was sheltered. In the whole 162 miles I had to re-run only 4 miles, and Mr. de la Condamine only six miles. In nearly every one of these miles the limit of 0.017 feet was largely, exceeded, and was due to some obvious unfavourable cause which would have had practically as great an effect whatever the speed. The discrepancy for a mile exceeded 0.010 feet in only 26 per cent of the whole mileage.

It has been stated by more than one level organization that a small percentage of re-running indicates excessive care and slowness, and that the speed should be such that ten per cent of the line should require to be re-run. In other words that if a certain limit of error is set, it should be exceeded in one mile in ten in order to adjust the speed to the extreme limit. I do not follow the reasoning which instructs a leveller not to admit miles having a discrepancy greater than a certain limit into his final returns and yet instructs him to go so fast that he should exceed this limit occasionally. With a limit so high as 0.017 feet x $\sqrt{\text{number}}$ of miles between bench marks, say four miles apart or a total of 0.034 feet, it seems that a speed deliberately set to exceed this limit would be such as to cause detriment to the precision. The discrepancy found is not, by any means, in itself a guarantee that the apparent precision is really attained, if the speed is set beyond the extreme limit of the observer's skill. At the end of his season he has admittedly gone beyond the limit of his skill in ten per cent of the work, and the fact that such results are cut out of the final line appears somewhat like a method of rejecting certain observations in order to reduce the final probable error.

Whatever may be said in favour of instructing a leveller that he should deliberately go so fast as to exceed the limit allowed in ten per cent of the mileage, it is an instruction which does not appear in many of the best level organizations.

Warman to Islay, 193 miles; and Prince Albert to Warman, 73 miles.—These two lines were run by Mr. L.O.R. Dozois, D.L.S. The first was commenced at Warman on June 5, 1912, and ended on September 24. Mr. Dozois then proceeded to Prince Albert and levelled southerly to Warman, where he ended the season's work on October 26. The running of this last line closed a gap in the levels, and formed a continuous line of levels from Hudson Bay Junction to Islay, 428 miles in all.

Along the line west of Warman, bench-marks were placed one at each station and one midway between stations for the first few stations, after which the midway bench-mark was omitted owing to the difficulty of transport of cement, gravel and tools, and, as a compromise, two bench-marks were established near every station. The stations average seven to eight miles apart, and the two bench-marks are placed one about a quarter of a mile east of the station, and the second about the same distance west of the station. The bench-marks consist of concrete pillars in the great majority of cases.

On the line from Prince Albert to Warman the bench-marks are, as a rule, on buildings.

Considerable trouble was caused, especially on the Warman to Islay line, by frequent high winds, the lines being generally over almost open prairie. From Warman to Bresaylor this line gives good results, but west of Bresaylor a marked

negative discrepancy began to accumulate. This was probably, in a large measure, due to the track being re-ballasted west of Bresaylor. This may have given rise to a persistent settling of the turning points on the rail as the car passed over them in moving forward from one instrument station to another. There undoubtedly might be a tendency this way, but under similar circumstances when running the line of levels from Edmonton to Athabaska Landing, no persistent systematic error was shown to be brought about by this cause, although the track was an entirely new one, and only ballasted with sand a few days previous to the running of the line of levels.

Whatever the cause, the discrepancy is negative almost continuously west of Bresaylor, although the individual intervals between bench-marks, except in a very few instances, are all within the specified limit.

The probable error of the mean of a mile section is 0.0039 feet.

The line of levels from Prince Albert to Warman was run under more favourable conditions as regards absence of wind. The probable error of the mean of a mile section is 0.037 feet. The total accumulated discrepancy for 73 miles is 0.134 feet. This line was run more speedily than any other line, the whole distance, including a day's work in connection at each end, being done in 31 days, between September 26 and Octotber 26.

I have the honour, to be, Sir,
Your obedient servant,

J. N. WALLACE, D.L.S.

APPENDIX No. 52.

MAGNETIC OBSERVATIONS.

This appendix contains the results of magnetic declination observations received during the year ended March 31, 1913.

Each observed declination has been reduced to the mean of the month in which the observation was taken by means of the continuous observations at the magnetic observatory at Agincourt.

A table is also given of the results of the observations for the determination of magnetic dip and total intensity taken in the years 1908 and 1910.

MAGNETIC DECLINATION.

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
40·00 N.—SE. cor. sec. 16	18	1	E.Pr.	May 29	12 34·3	C. F. Aylsworth
40·00 N.— " 16	18	1	"	June 3	12 31·6	"
50·00 E.—NE. " 9	18	1	"	" 5	12 34·7	"
40·00 N.—SE. " 16	18	1	"	May 28	12 25·9	"
At NE. cor. sec. 3	16	6	"	July 1	12 46·2	"
7·00 S.—NE. cor. sec. 25	25	6	"	Aug. 12	11 58·3	"
21·00 N.—NE. " 24	25	6	"	" 12	11 56·9	"
At NE. cor. sec. 4	25	6	"	" 27	11 25·5	"
13·00 E.—NE. cor. sec. 3	25	6	"	" 29	11 33·2	"
At NE. cor. sec. 9	25	9	"	" 26	11 35·1	"
" 11	16	11	"	July 1	13 04·0	"
38·00 S.—NE. cor. sec. 35	10	13	"	Nov. 22	10 55·9	W. J. Deans.
25·00 S.—NE. " 35	10	13	"	" 23	12 48·0	"
57·00 W.—SE. " 1	11	13	"	" 25	10 34·6	"
57·00 W.—SE. " 1	11	13	"	" 25	10 34·6	"
72·00 W.—NE. " 33	10	14	"	Oct. 14	10 57·4	"
40·00 W.—NE. " 32	10	14	"	" 15	10 57·1	"
55·00 E.—NW. " 13	10	14	"	" 17	9 55·8	"
55·00 W.—SE. " 3	11	14	"	" 19	12 41·7	"
45·00 W.—SE. " 6	11	14	"	" 21	10 51·4	"
15·00 S.—NE. " 23	11	14	"	" 24	10 43·8	"
At NE. cor. sec. 35	11	14	"	" 18	11 46·5	"
5·00 N.—NE. cor. sec. 36	11	14	"	Nov. 19	11 14·0	"
10·00 S.—NE. " 32	10	15	"	" 5	10 44·2	"
55·00 S.—NE. " 18	11	15	"	Oct. 25	10 52·1	"
48·00 S.—NE. " 5	12	15	"	Nov. 18	10 36·1	"
At NE. cor. sec. 25	7	16	"	Sept. 4	8 02·2	"
" "	7	16	"	" 7	8 23·5	"
70·00 S.—¼ post N. by sec. 24	7	16	"	" 11	8 34·0	"
48·00 S.— " " 36	7	16	"	" 12	7 45·1	"
37·00 N.—SE. cor. sec. 1	8	16	"	" 16	8 16·5	"
59·00 S.—¼ post N. by sec. 1	8	16	"	" 18	7 25·9	"
25·00 W.—NE. cor. sec. 30	7	17	"	" 2	8 26·1	"
At NE. cor. sec. 30	7	17	"	" 9	8 46·0	"
6·00 N.—NE. cor. sec. 24	9	17	"	" 15	8 36·0	G. A. Bennett.
16·00 N.— " 1	9	17	"	" 18	9 25·3	"
38·11 N.— " 25	9	17	"	" 27	8 57·2	"
49·00 N.— " 25	9	17	"	" 27	8 57·1	"
49·00 N.— " 25	9	17	"	" 27	9 06·8	"
25·5 N.— " 1	10	17	"	Oct. 7	9 28·2	"
25·5 N.— " 1	10	17	"	" 8	8 43·9	"
11·00 S.— " 36	10	17	"	" 12	11 09·5	"
57·00 N.— " 13	10	17	"	" 13	9 06·5	"
25·50 N.— " 1	10	17	"	" 14	8 38·5	"
57·00 N.— " 13	10	17	"	" 14	9 06·9	"
57·00 N.— " 13	10	17	"	" 14	9 08·2	"
At NE. cor. sec. 12	1	1	Pr.	May 19	12 16·4	A. G. Stuart.

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
At NE. cor. sec. 12	1	1	Pr.	May 19	12 14·0	A. G. Stuart.
" " 13	2	1	"	" 20	12 06·2	"
" " 13	2	1	"	" 20	12 14·2	"
40·00 N.—NE. cor. sec. 24	3	1	"	" 24	13 15·2	"
At NE. cor. sec. 25 (trial line)	5	1	"	" 29	13 02·4	"
" " 25 "	5	1	"	" 29	13 15·8	"
Centre E. by sec. 36 "	6	1	"	June 3	12 21·0	"
" " 36 "	6	1	"	" 3	12 20·9	"
" " 24 "	7	1	"	" 5	13 11·6	"
" " 24 "	7	1	"	" 5	13 09·7	"
" " 36 "	8	1	"	" 7	13 49·5	"
" " 25	9	1	"	" 11	13 55·6	"
" " 25	9	1	"	" 11	13 51·2	"
" " 1	10	1	"	" 12	13 54·4	"
" " 1	10	1	"	" 12	13 55·0	"
" " 24 (trial line)	11	1	"	" 19	13 55·3	"
" " 24 "	11	1	"	" 19	13 54·6	"
" " 13	13	1	"	" 26	13 23·3	"
At NE. cor. sec. 13 (trial line)	13	1	"	" 27	13 34·9	"
" " 24 "	14	1	"	July 4	13 37·5	"
40·00 N.—NE. cor. sec. 1	15	1	"	" 6	13 34·9	"
At ¼ post E. by sec. 13	15	1	"	" 9	14 03·1	"
Centre E. by sec. 1	16	1	"	" 10	13 10·3	"
" " 1	16	1	"	" 10	13 12·8	"
At NE. cor. sec. 24	17	1	"	" 22	13 26·2	"
" " 13	17	1	"	" 23	12 57·1	"
10·00 N.—NE. cor. sec. 36	17	1	"	" 25	12 38·8	"
10·00 N.— " 36	17	1	"	" 25	12 37·7	"
At NE. cor. sec. 36	19	1	"	Aug. 3	12 42·2	"
38·00 chs. on E. by sec. 13	20	1	"	" 6	12 44·4	"
20·00 N.—NE. cor. sec. 25	20	1	"	" 9	13 13·6	"
" " 25	20	1	"	" 9	13 16·3	"
1·87 N.— " 13	21	1	"	" 18	13 21·1	"
" " 13	21	1	"	" 18	13 19·1	"
At NE. cor. sec. 24	22	1	"	" 22	13 33·0	"
" " 25	22	1	"	" 24	13 41·5	"
At ¼ post on E. by sec. 36	23	1	"	" 30	13 26·5	"
" " 36	23	1	"	" 30	13 27·8	"
60·00 N.—NE. cor. sec. 12	24	1	"	Sept. 2	13 06·2	"
" " 12	24	1	"	" 2	13 05·8	"
30·00 N.— " 12	25	1	"	" 7	13 14·9	"
At NE. cor. sec. 13	26	1	"	" 18	13 09·2	"
" " 13	26	1	"	" 18	13 07·7	"
" " 36	27	1	"	" 24	12 43·5	"
" " 36	27	1	"	" 24	12 49·3	"
Centre E. by sec. 24	28	1	"	" 27	12 26·0	"
" " 24	28	1	"	" 27	12 24·3	"
" " 24	28	1	"	" 27	12 26·2	"
21·60 W.—NE. cor. sec. 31	60	1	"	Nov. 13	14 24·7	O. Rolfson.
" " 31	60	1	"	" 13	14 19·4	"
" " 31	60	1	"	" 13	14 24·1	"
" " 31	60	1	"	" 13	14 24·4	"
" " 31	60	1	"	" 13	14 26·4	"
" " 31	60	1	"	" 14	13 47·7	"
" " 31	60	1	"	" 14	14 37·6	"
" " 31	60	1	"	" 14	14 21·1	"
" " 31	60	1	"	" 14	14 22·1	"
" " 31	60	1	"	" 14	14 04·1	"
32·50 W.— " 32	60	1	"	Oct. 25	14 37·2	"
59·42 W.— " 32	60	1	"	" 29	14 08·0	"
21·66 W.— " 31	60	1	"	Nov. 13	14 29·9	"
" " 31	60	1	"	" 13	14 26·5	"
" " 31	60	1	"	" 13	14 23·3	"
12·79 N.— " 12	61	1	"	June 14	14 18·7	G. H. Herriot.
39·25 N.— " 24	61	1	"	" 19	13 35·6	"
16·53 N.— " 24	62	1	"	" 28	14 06·5	"
30·68 N.— " 24	63	1	"	July 10	13 42·9	"
59·75 W.— " 32	64	1	"	Aug. 15	12 28·7	O. Rolfson.
4·55 N.— " 24	66	1	"	" 7	13 58·6	G. H. Herriot.
76·82 N.— " 13	67	1	"	" 14	11 53·0	"

MAGNETIC DECLINATION.—*Continued*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
78·91 N.—NE. cor. sec. 24	68	1	Pr.	Aug. 24	12 38·1	G. H. Herriot.
58·45 N.— " 13	70	1	"	Sept. 10	14 26·3	"
35·00 N.— " 24	70	1	"	" 11	14 50·0	"
26·29 N.— " 1	72	1	"	" 30	14 14·6	"
" " 1	72	1	"	" 30	14 11·5	"
76·50 N.— " 12	72	1	"	" 30	11 54·9	"
At NE. cor. sec. 33	17	2	"	Dec. 28	12 37·3	G. A. Bennett.
" " 3	18	2	"	" 26	12 37·3	"
" " 9	18	2	"	" 27	12 39·4	"
16·00 N.—NE. cor. sec. 7	21	2	"	Aug. 26	13 37·3	"
" " 7	21	2	"	" 26	13 36·9	"
At NE. cor. sec 7	21	2	"	" 26	13 35·3	"
16·00 E.—NE. cor. sec. 7	21	2	"	" 26	13 30·9	"
" " 7	21	2	"	" 26	13 30·8	"
67·42 W.— " 35	56	2	"	July 16	14 01·1	O. Rolfson.
At NE. cor. sec. 33	56	2	"	" 17	14 12·8	"
29·87 W.—NE. cor. sec. 31	56	2	"	" 19	14 53·0	"
24·42 W.— " 34	64	2	"	Aug. 19	14 03·3	"
47·50 W.— " 35	60	3	"	Nov. 22	14 14·3	"
10·00 N.— " 22	21	4	"	" 27	13 48·0	A. G. Stuart.
" " 22	21	4	"	" 27	13 46·8	"
5·00 S.—¼ post E. by sec. 23	21	4	"	" 5	13 49·4	"
" " 23	21	4	"	" 5	13 49·0	"
At NE. cor. sec. 35	64	4	"	Sept. 3	14 38·2	O. Rolfson.
At NE. cor. sec. 5	22	5	"	Oct. 4	13 16·1	C. F. Aylsworth
4·00 N.—NE. cor. sec. 4	22	5	"	" 30	13 26·2	"
23·00 W.— " 21	22	5	"	" 30	13 26·1	"
3·00 S.— " 19	22	5	"	" 30	13 27·3	"
20·00 E.— " 19	22	5	"	" 30	13 30·1	"
4·00 W.— " 3	22	5	"	Nov. 5	13 34·7	"
20·00 N.— " 3	22	5	"	" 5	13 33·9	"
5·00 W.— " 10	22	5	"	" 6	13 26·4	"
35·00 S.— " 11	22	5	"	" 7	13 37·7	"
12·00 S.— " 22	22	5	"	" 8	13 15·8	"
35·00 E.— " 10	22	5	"	" 9	13 28·1	"
5·00 W.— " 14	22	5	"	" 11	13 29·0	"
10·00 W.— " 26	22	5	"	" 28	12 26·9	"
20·00 N.— " 26	22	5	"	" 28	11 55·6	"
12·00 S.— " 25	22	5	"	" 29	13 20·3	"
25·00 W.— " 25	22	5	"	" 29	13 06·0	"
14·00 W.— " 6	23	5	"	Oct. 29	13 23·6	"
At SE. cor. sec. 5	23	5	"	" 26	13 23·8	"
7·00 E.—SE. cor. sec. 5	23	5	"	" 26	13 24·5	"
10·00 W.— " 2	23	5	"	Nov. 26	14 07·8	"
15·00 N.— " 2	23	5	"	" 26	13 51·6	"
59·67 W.—NE. " 31	60	5	"	Dec. 9	13 47·1	O. Rolfson.
16·70 W.— " 33	64	5	"	Sept. 16	13 48·9	"
26·00 W.— " 29	21	7	"	May 19	13 06·5	G. A. Bennett.
" " 29	21	7	"	" 19	13 05·4	"
" " 29	21	7	"	" 19	13 05·6	"
" " 29	21	7	"	" 19	13 03·5	"
" " 29	21	7	"	" 19	13 02·9	"
" " 29	21	7	"	" 19	13 03·9	"
" " 29	21	7	"	" 19	13 07·6	"
" " 29	21	7	"	" 19	13 11·8	"
" " 29	21	7	"	" 19	13 11·0	"
" " 29	21	7	"	" 19	13 08·0	"
8·00 N.—NW. cor. sec. 36	21	7	"	Sept. 3	12 56·9	"
At NW. cor. sec. 7	28	7	"	July 29	13 26·7	P.R.A.Belanger.
20·00 S.—NE. cor. sec. 6	29	7	"	Aug. 8	13 16·6	"
77·15 W.—NE. " 36	60	7	"	Dec. 13	14 07·2	O. Rolfson.
8·00 N.—NW. " 36	21	8	"	Sept. 3	12 59·2	G. A. Bennett.
24·00 W.—NE. " 10	28	8	"	July 27	13 03·7	P.R.A.Belanger.
15·00 W.— " 10	29	8	"	Aug. 2	13 29·3	"
9·19 W.— " 35	60	8	"	Dec. 25	17 24·7	O. Rolfson.
1·00 N.— " 31	5	9	"	Oct. 1	13 56·5	G. A. Bennett.
" " 31	5	9	"	" 1	13 58·3	"
38·00 S.— " 14	31	9	"	Nov. 23	13 54·8	A. G. Stuart.
" " 14	31	9	"	" 23	14 00·8	"
" " 14	31	9	"	" 23	13 56·3	"
At NE. cor. sec. 30	18	10	"	July 16	12 54·1	G. A. Bennett.

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
At NE. cor. sec. 30	18	10	Pr.	July 16	12 58·0	G. A. Bennett.
" " 30	18	10	"	" 16	12 58·0	"
22·00 N.—NE. cor. sec. 5	21	11	"	" 6	14 03·2	J. Francis.
21·00 N.— " 8	21	11	"	" 9	14 04·3	"
18·00 W.— " 5	21	11	"	" 11	13 58·2	"
1·00 N.— " 3	21	11	"	" 17	13 54·9	"
3·00 N.— " 14	21	11	"	" 25	13 54·0	"
At NE. cor. sec. 11	21	11	"	" 26	14 04·7	"
45·00 N.—NE. cor. sec. 27	21	11	"	" 30	13 54·1	"
69·00 N.— " 26	21	11	"	Aug. 1	14 05·4	"
26·00 N.— " 20	21	11	"	" 5	13 53·4	"
64·00 N.— " 20	21	11	"	" 7	13 07·9	"
At NW. cor. sec. 31	8	12	"	" 19	14 57·3	P.R.A.Belanger.
At NE. " 36	20	12	"	July 3	14 21·5	J. Francis.
50·00 S.—NE. cor. sec. 7	21	12	"	Dec. 26	14 01·9	W. J. Deans.
18·00 S.— " 7	21	12	"	June 13	14 50·7	J. Francis.
32·00 E.— " 16	21	12	"	Aug. 28	14 41·2	"
At NE. cor. sec. 18	21	12	"	Sept. 18	14 43·9	"
41·00 S.—NE. cor. sec. 36	22	12	"	Aug. 20	14 41·2	"
38·00 W.— " 19	22	12	"	Dec. 31	14 56·7	W. J. Deans.
70·00 S.— " 3	21	13	"	" 23	14 25·9	"
72·00 S.— " 2	21	13	"	" 24	15 02·1	"
18·00 W.— " 5	21	13	"	June 24	15 03·6	J. Francis.
36·00 N.— " 13	21	13	"	April 24	14 54·6	"
37·50 N.— " 25	21	13	"	" 25	14 51·3	"
39·50 W.— " 35	21	13	"	" 26	14 27·4	"
At NE. cor. sec. 34	21	13	"	" 28	14 05·3	"
" " 26	21	13	"	May 1	14 27·5	"
15·00 W.—NE. cor. sec. 14	21	13	"	" 2	14 44·1	"
27·00 E... " 23	21	13	"	" 8	14 44·9	"
32·00 E.— " 22	21	13	"	" 9	14 45·2	"
26·00 E.— " 15	21	13	"	" 10	14 48·4	"
68·00 N.— " 34	21	13	"	" 16	14 34·4	"
41·00 S.— " 2	21	13	"	" 27	14 59·1	"
47·00 W.— " 12	21	13	"	" 28	14 51·5	"
55·00 S.— " 3	21	13	"	" 29	14 56·1	"
17·00 E.— " 2	21	13	"	" 31	14 49·5	"
10·00 N.— " 18	21	13	"	June 8	14 46·3	"
19·00 E.— " 18	21	13	"	" 12	14 44·0	"
25·00 W.— " 19	21	13	"	" 14	15 23·4	"
60·00 W.— " 15	22	13	"	Dec. 28	14 08·2	W. J. Deans.
35·00 W.— " 36	22	13	"	May 15	14 55·5	J. Francis.
45·00 N.— " 4	22	13	"	" 18	14 47·3	"
20·00 W.— " 3	22	13	"	" 21	14 30·1	"
38·00 W.— " 10	22	13	"	" 22	14 41·3	"
9·00 E.— " 15	22	13	"	" 23	14 41·7	"
8·00 S.— " 17	22	13	"	June 18	14 58·4	"
40·00 W.— " 4	22	13	"	" 19	14 44·2	"
17·00 N.— " 6	22	13	"	" 20	15 15·2	"
At NE. cor. sec. 25	21	14	"	" 7	14 50·9	"
" " 23	30	15	"	Dec. 18	15 27·9	G. A. Bennett.
14·00 E.—NE. cor. sec. 8	33	19	"	June 17	15 43·7	"
" " 8	33	19	"	" 16	15 38·5	"
8·00 E.— " 31	19	20	"	Aug. 1	14 09·0	"
34·00 E.— " 9	37	20	"	July 4	16 52·8	P.R.A.Belanger
At SE. cor. sec. 3	38	20	"	" 10	19 10·9	"
8·00 N.—NE. cor. sec. 36	19	21	"	" 27	14 28·7	G. A. Bennett.
52·00 N.— " 36	19	21	"	" 29	14 25·8	"
At NE. cor. sec. 32	34	21	"	June 24	16 16·2	P.R.A.Belanger.
15·00 S.—NE. cor. sec. 3	35	21	"	" 20	16 12·9	"
15·00 S.— " 12	55	26	"	July 13	19 33·8	E. W. Berry.
16·00 S.— " 23	55	26	"	" 31	18 37·8	"
66·00 S.— " 2	55	26	"	Aug. 8	19 15·3	"
60·00 S.— " 30	57	26	"	Dec. 28	18 30·8	"
68·00 S.— " 29	52	28	"	Aug. 22	18 05·5	"
52·00 E.— " 19	52	28	"	" 26	17 36·4	"
68·00 E.— " 23	52	28	"	" 29	19 19·6	"
20·00 N.— " 4	53	28	"	July 18	18 48·3	"
16·00 N.— " 3	53	28	"	" 22	19 31·3	"
32·00 S.— " 15	53	28	"	Sept. 9	19 16·2	"
8·00 E.— " 33	51	29	"	Oct. 5	18 43·5	"

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
62·00 E.—NE. cor. sec. 32	51	29	Pr.	Oct. 10	18 46·0	E. W. Berry.
41·00 S.— " 1	52	29	"	Sept. 17	19 06·0	"
36·00 S.— " 9	52	29	"	Oct. 25	19 32·8	"
41·00 N.— " 5	52	29	"	" 16	19 11·7	"
At NE. cor. sec. 4	28	30	"	" 25	16 20·6	G. A. Bennett.
" " 4	28	30	"	" 25	16 21·1	"
6·00 E.—NE. cor. sec. 33	18	31	"	" 29	17 41·4	"
At NE. cor. sec. 36	18	31	"	" 31	16 43·7	"
32·00 E.—NE. cor. sec. 32	18	31	"	Nov. 1	17 40·5	"
At NE. cor. sec. 36	18	31	"	" 2	16 34·6	"
23·50 E.—NE. cor. sec. 35	18	31	"	" 2	16 50·0	"
10·00 W.— " 31	18	31	"	" 2	17 36·0	"
48·00 E.—SE. " 5	19	31	"	" 1	17 35·1	"
At SE. cor. sec. 1	19	31	"	" 1	17 08·1	"
5·00 E.—SE. cor. sec. 3	18	32	"	" 8	17 45·0	"
At NE. cor. sec. 31	18	32	"	" 9	17 53·7	"
At SE. " 24	31	32	"	Oct. 26	17 12·9	"
" " 24	31	32	"	" 26	17 06·2	"
45·00 W.—NE. cor. sec. 35	18	33	"	Nov. 11	18 05·3	"
12·00 W.— " 32	18	33	"	" 13	17 58·2	"
40·00 E.— " 32	18	33	"	" 15	17 57·4	"
50·00 W.—SE. " 2	19	33	"	" 12	18 09·2	"
30·00 N.—SE. cor. sec. 1	19	1	2	Nov. 14	18 04·9	G. A. Bennett.
14·00 S.—NE. " 28	34	1	2	June 10	19 33·9	"
40·00 N.— " 28	34	1	2	" 11	19 46·8	"
40·00 N.— " 28	34	1	2	" 11	19 37·1	"
16·67 N.— " 13	61	1	2	" 26	19 52·0	J. A. Fletcher.
" " 13	61	1	2	" 26	19 51·7	"
" " 13	61	1	2	" 27	19 50·5	"
" " 13	61	1	2	" 27	19 50·1	"
" " 13	61	1	2	" 28	19 48·2	"
" " 13	61	1	2	" 28	19 48·1	"
36·00 S.— " 34	26	2	2	Sept. 16	19 49·2	B. H. Segre.
20·00 E.— " 35	14	4	2	Aug. 13	17 11·2	G. A. Bennett.
" " 35	14	4	2	" 13	17 00·0	"
At NE. cor. sec. 32	13	5	2	Dec. 7	17 44·5	"
" " 9	14	5	2	" 3	17 49·1	"
" " 8	15	5	2	Nov. 30	17 56·2	"
30·00 W.—NE. cor. sec. 19	26	6	2	" 22	18 13·6	"
36·00 S.— " 29	40	8	2	May 24	20 18·3	P.R.A.Belanger.
At NE. cor. sec. 31	39	9	2	June 6	19 41·7	"
10·00 N.—NE. cor. sec. 19	40	9	2	" 2	20 05·7	"
At SE. cor. sec. 5	41	9	2	May 29	20 15·0	"
38·00 N.—SE. cor. sec. 32	45	9	2	Aug. 19	20 34·4	W. J. Deans.
3·00 E.—NE. cor. sec. 31	56	9	2	Jan. 11	19 18·5	E. W. Robinson.
20·00 W.— " 18	45	10	2	Oct. 24	20 26·6	G. A. Bennett.
10·00 E.— " 18	45	10	2	" 24	20 20·9	"
40·00 W.— " 18	45	10	2	" 24	20 27·3	"
20·00 W.— " 36	45	10	2	Aug. 17	20 20·6	W. J. Deans.
At NE. cor. sec. 36	45	10	2	" 18	19 50·7	"
10·00 W.—NE. cor. sec. 36	56	10	2	Jan. 12	18 58·1	E. W. Robinson
24·00 W.— " 33	56	10	2	" 15	18 21·1	"
At NE. cor. sec. 13	45	11	2	Oct. 24	20 07·7	G. A. Bennett.
65·00 W.—NE. cor. sec. 34	56	11	2	Jan. 18	18 27·8	E. W. Robinson
16·50 W.— " 31	56	11	2	" 20	20 23·0	"
55·00 W.— " 35	56	12	2	" 22	21 46·1	"
73·00 W.— " 34	56	12	2	" 23	21 59·6	"
20·00 W.— " 31	56	12	2	" 25	21 11·5	"
5·00 W.— " 33	56	13	2	" 27	21 03·2	"
3·00 W.— " 32	56	13	2	" 30	21 39·0	"
68·00 S.— " 31	6	14	2	June 23	17 22·3	G. A. Bennett.
" " 31	6	14	2	" 23	17 18·0	"
" " 31	6	14	2	" 23	17 17·4	"
At NE. cor. sec. 11	27A	14	2	July 22	19 33·6	F. V. Seibert.
" " 11	27A	14	2	" 20	19 27·8	"
" " 11	27A	14	2	" 23	19 26·5	"
" " 11	27A	14	2	" 25	19 30·8	"
56·00 W.—NE. cor. sec. 35	56	14	2	Feb. 1	21 50·1	E. W. Robinson.
50·00 W.— " 32	56	14	2	" 3	21 27·5	"
5·00 W.— " 33	56	15	2	" 6	21 42·3	"

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
41·00 N.—NE. cor. sec. 35	4	16	2	Aug. 17	18 03·5	G. A. Bennett.
" " 35	4	16	2	" 17	18 00·4	"
40·00 N.— " 35	4	16	2	" 17	18 16·4	"
51·00 E.— " 32	56	16	2	Feb. 12	21 48·4	E. W. Robinson.
38·00 W.— " 34	56	17	2	" 16	21 43·7	"
75·00 W.— " 33	56	17	2	" 17	21 41·9	"
46·00 W.— " 31	56	17	2	" 19	22 51·2	"
At NE. cor. sec. 31	52	18	2	Nov. 4	20 36·0	P.R.A.Belanger.
At SE. cor. sec. 6	53	18	2	" 5	20 37·4	"
17·58 W.—NE. cor. sec. 34	56	18	2	Feb. 22	23 28·0	E. W. Robinson.
" " 34	56	18	2	" 23	23 24·5	"
65·00 W.— " 33	56	18	2	" 23	23 19·3	"
65·00 W.— " 33	56	18	2	" 24	23 15·7	"
15·00 S.— " 36	27	19	2	Sept. 7	19 09·1	B. H. Segre.
18·00 S.— " 1	33	19	2	Nov. 22	20 10·8	C. Rinfret.
40·00 S.—NW. " 30	46	19	2	July 22	21 44·7	R. C. Purser.
64·00 W.—NE. " 35	56	19	2	Feb. 26	23 35·4	E. W. Robinson.
75·43 W.— " 31	56	19	2	" 28	23 01·1	"
At SW. cor. frac. sec. 36A	46	20	2	Sept. 26	21 58·4	R. C. Purser.
At NE. cor. sec. 32	52	20	2	Nov. 1	22 07·2	P.R.A.Belanger.
At SE. cor. sec. 5	53	20	2	" 1	22 06·9	"
75·00 W.—NE. cor. sec. 35	56	20	2	Feb. 29	23 23·6	E. W. Robinson.
10·00 W.— " 33	56	20	2	Mar. 1	23 14·5	"
27·00 W.— " 32	56	20	2	" 2	23 20·4	"
48·00 W.— " 31	56	20	2	" 4	23 15·4	"
10·00 S.— " 16	13	24	2	June 24	19 06·6	C. Rinfret.
10·00 N.— " 7	14	24	2	" 18	19 26·1	"
At NE. cor. sec. 31	15	25	2	Nov. 26	19 19·3	G. A. Bennett.
" " 21	24	25	2	July 15	20 09·9	F. V. Seibert.
40·00 S.—NE. cor. sec. 20	26	25	2	" 16	19 39·8	"
40·50 E.— " 34	15	26	2	Nov. 25	19 16·1	G. A. Bennett.
" " 34	15	26	2	" 25	19 17·1	"
10·00 W.—SE. " 6	31	26	2	Oct. 9	21 33·8	B. H. Segre.
40·00 S.—NE. " 2	24	27	2	Nov. 5	20 33·5	"
At SE. cor. sec. 2	43	28	2	Sept. 21	21 13·6	R. C. Purser.
41·84 N.—NE. cor. sec. 36	13	29	2	July 13	19 27·9	C. Rinfret.
At NW. cor. sec. 19	14	29	2	" 23	19 48·6	"
15·00 S.—NE. cor. sec. 34	14	29	2	Aug. 9	19 58·1	"
1·00 S.— " 20	14	29	2	" 10	19 38·5	"
20·00 N.— " 25	7	1	3	July 2	19 28·9	F. V. Seibert
5·00 S.— " 17	14	1	3	" 17	20 01·6	C. Rinfret.
5·00 S.— " 10	14	1	3	Oct. 25	20 32·8	"
At SE. cor. sec. 5	39	1	3	June 10	22 17.5	R. C. Purser
20·00 E.—NE. cor. sec. 11	54	1	3	Sept. 24	23 27·3	P.R.A.Belanger.
At NE. cor. sec. 9	55	1	3	Oct. 2	23 40·4	"
" " 7	56	1	3	Sept. 25	22 52·1	"
30·00 S.—NE. cor. sec. 13	57	1	3	July 24	23 11·9	J. A. Fletcher.
" " 13	57	1	3	" 24	23 12·6	"
" " 13	57	1	3	" 25	23 12·9	"
" " 13	57	1	3	" 25	23 13·5	"
" " 13	57	1	3	" 27	23 12·3	"
" " 13	57	1	3	" 27	23 13·5	"
78·00 N.— " 36	64	1	3	April 14	23 44·0	A. Saint-Cyr.
70·00 N.— " 25	65	1	3	" 19	24 23·7	"
14·00 N.— " 36	65	1	3	" 22	24 09·1	"
23·00 N.— " 25	66	1	3	May 2	23 54·3	"
33·00 N.— " 36	66	1	3	" 6	23 44·8	"
39·00 N.— " 2	67	1	3	" 10	23 45·6	"
22·00 N.— " 24	67	1	3	" 14	23 45·2	"
24·00 N.— " 12	68	1	3	" 23	23 28·2	"
76·00 W.— " 32	68	1	3	June 4	23 24·3	"
37·00 N.— " 28	13	2	3	Aug. 2	20 36·2	C. Rinfret.
29·00 S.— " 3	14	2	3	July 29	20 33·0	"
18·00 W.— " 36	68	2	3	June 5	23 56·7	A. Saint-Cyr.
47·00 W.— " 35	68	2	3	" 11	21 59·5	"
68·00 W.— " 35	68	2	3	" 12	22 11·4	"
33·00 W.— " 33	68	2	3	" 13	22 20·0	"
30·00 S.— " 21	25	3	3	Oct. 23	21 01·0	B. H. Segre.
20·00 N.— " 25	34	3	3	May 22	22 43·6	R. C. Purser.
48·00 W.— " 36	68	3	3	June 17	21 12·8	A. Saint-Cyr.
60·00 W.— " 33	68	3	3	" 20	24 06·6	"

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
64·00 W.—NE. cor. sec. 32	68	3	3	June 22	25 09·3	A. Saint Cyr.
10·00 W.— " 36	68	4	3	" 24	26 02·0	"
54·00 W.— " 33	68	4	3	" 28	23 44·6	"
At NE. cor. sec. 19	49	5	3	Oct. 8	20 37·2	R. C. Purser.
65·00 S.—NE. cor. sec. 6	49	5	3	" 9	20 46·4	"
30·00 E.— " 7	49	5	3	" 4	20 53·7	"
2·50 W.— " 36	68	5	3	July 5	22 51·7	A. Saint-Cyr.
50·00 W.— " 36	68	5	3	" 8	24 34·9	"
54·00 W.— " 33	68	5	3	" 12	23 51·0	"
53·00 W.— " 32	68	5	3	" 15	23 28·6	"
60 00 W.— " 31	68	5	3	" 16	23 07·8	"
At ¼ post N. by sec. 24	33	6	3	Aug. 29	22 56·1	R. C. Purser.
3·40 S.—NE. cor. sec. 18	49	6	3	Oct. 14	21 54·9	"
65·10 W.—SW. " 16	49	6	3	" 15	21 17·3	"
13·81 W.—NE. cor. sec. 18	49	6	3	Nov. 28	21 31·6	R. C. Purser.
10·00 S.—NW. " 20	56	6	3	Oct. 15	22 26·9	P.R.A.Belanger.
74·00 W.—NE. " 36	68	6	3	July 20	23 53·2	A. Saint-Cyr.
60·00 W.— " 35	68	6	3	" 22	25 19·4	"
48·00 W.— " 34	68	6	3	" 23	24 43·5	"
60·00 W.— " 34	68	6	3	" 24	24 42·2	"
18·00 W.— " 32	68	6	3	" 25	23 25·3	"
46·00 W.— " 31	68	6	3	" 26	25 22·2	"
At NE. cor. sec. 6	26	7	3	May 24	21 40·1	F. V. Seibert.
" " 6	26	7	3	" 25	21 32·5	"
3·70 S.—NE. cor. sec. 36	49	7	3	Oct. 16	22 21·3	R. C. Purser.
32·00 E.— " 24	49	7	3	Nov. 26	21 29·6	"
37·00 E.— " 24	49	7	3	" 26	21 25·6	"
37·00 E.— " 24	49	7	3	" 27	21 32·5	"
10·00 W.— " 24	56	7	3	Oct. 13	22 41·4	P.R.A.Belanger.
40·00 W.— " 12	57	7	3	" 8	22 45·2	"
56·00 W.— " 34	68	7	3	July 29	25 09·4	A. Saint-Cyr.
17·00 W.— " 32	68	7	3	" 30	24 33·8	"
5·00 E.— " 22	53	8	3	June 17	21 43·0	W. J. Deans.
At NE. cor. sec. 21	54	8	3	" 14	22 25·7	"
8·00 W.—SE. cor. sec. 4	55	8	3	" 15	21 32·0	"
13·00 W.—NE. cor. sec. 36	68	8	3	Aug. 1	24 47·2	A. Saint-Cyr.
74·00 W.— " 36	68	8	3	" 2	25 28·6	"
73·00 W.— " 35	68	8	3	" 3	25 34·4	"
32·00 W.— " 33	68	8	3	" 5	24 48·8	"
56·00 W.— " 32	68	8	3	" 6	24 22·5	"
67·00 W.— " 36	68	9	3	" 8	25 05·1	"
25·00 W.— " 34	68	9	3	" 14	25 58·3	"
28·00 W.— " 33	68	9	3	" 15	25 57·3	"
42·00 W.— " 32	68	9	3	" 16	26 08·6	"
38·50 W.— " 31	68	9	3	" 17	26 00·9	"
At NE. cor. sec. 31	16	10	3	Oct. 1	21 26·6	F. V. Seibert.
50·00 E.—NE. cor. sec. 31	31	10	3	May 28	21 57·8	R. C. Purser.
At NE. cor. sec. 32	32	10	3	June 3	21 52·8	"
46·00 W.—NE. cor. sec. 36	68	10	3	Aug. 19	26 56·6	A. Saint-Cyr.
47·00 W.— " 32	68	10	3	" 21	27 45·7	"
At NE. cor. sec. 36	16	11	3	Sept. 28	21 34·0	F. V. Seibert.
" " 36	16	11	3	Oct. 7	21 22·7	"
40·00 S.—NE. cor. sec. 2	17	11	3	" 4	20 59·5	"
At NE. cor. sec. 1	17	11	3	" 6	21 24·4	"
" " 2	17	11	3	" 3	21 10·7	"
40·00 S.—NE. cor. sec. 2	17	11	3	May 31	21 25·0	"
40·00 S.— " 2	17	11	3	June 21	21 19·7	"
3·00 W.— " 36	68	11	3	Aug. 22	27 48·4	A. Saint-Cyr.
49·00 W.— " 35	68	11	3	" 27	27 57·2	"
55·00 W.— " 32	68	11	3	" 30	26 54·4	"
67·00 W.— " 31	68	11	3	" 31	26 35·3	"
20·00 W.— " 31	50	12	3	July 4	23 53·1	W. J. Deans.
70·00 W.— " 31	50	12	3	" 5	24 19·4	"
20·00 W.—SE. " 6	51	12	3	June 29	24 36·8	"
At NE. cor. sec. 6	51	12	3	July 9	23 56·1	"
56·57 W.—NE. cor. sec. 18	61	12	3	Aug. 14	26 00·3	C. F. Miles.
55·44 W.— " 18	61	12	3	" 14	26 04·1	"
6·00 W.— " 35	68	12	3	Sept. 2	26 26·1	A. Saint-Cyr.
44·00 W.— " 34	68	12	3	" 3	26 29·8	"
26·00 W.— " 33	68	12	3	" 4	27 19·8	"
8·00 W.— " 31	68	12	3	" 9	22 44·4	"

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
60·00 S.—NE. cor. sec. 15	16	13	3	June 9	21 44·2	F. V. Seibert.
20·00 S.— " 15	16	13	3	" 11	21 51·4	"
20·00 S.— " 15	16	13	3	" 13	21 44·4	"
At NE. cor. sec. 26	26	13	3	Sept. 24	21 09·2	"
" " 25	26	13	3	" 24	21 06·6	"
80·00 W.—NE. cor. sec. 36	68	13	3	" 10	26 40·8	A. Saint-Cyr.
7·00 W.— " 34	68	13	3	" 11	26 26·3	"
14·00 W.— " 31	68	13	3	" 23	26 22·9	"
1·25 S.— " 8	13	14	3	July 16	20 43·9	S. L. Evans.
At NE. cor. sec. 9	13	14	3	" 17	20 58·3	"
22·00 W.—NE. cor. sec. 35	68	14	3	Sept. 25	25 39·2	A. Saint-Cyr.
57·00 W.— " 34	68	14	3	" 26	25 47·8	"
67·00 W.— " 33	68	14	3	" 28	25 50·3	"
40·00 N.— " 32	68	14	3	" 29	25 42·4	"
40·00 N.— " 32	68	14	3	" 29	25 43·6	"
At NE. cor. sec. 27	19	15	3	Aug. 4	22 21·3	F. V. Seibert.
26·70 W.—NE. cor. sec. 3	48	15	3	July 2	24 41·7	R. C. Purser.
40·00 N.— " 11	47	16	3	June 25	23 53·2	"
At NE. cor. sec. 11	47	16	3	" 26	24 14·6	"
" " 22	18	17	3	" 17	21 30·6	F. V. Seibert.
40·00 S.—NE. cor. sec. 21	17	18	3	" 7	21 07·4	"
At ¼ post—N. by sec. 20	36	19	3	Sept. 16	23 14·7	R. C. Purser.
At SW. cor. sec. 6	47	19	3	" 25	21 59·7	"
0·98 W.—NE. cor. sec. 19	8	22	3	June 4	21 49·1	S. L. Evans.
0·53 S.— " 21	8	22	3	" 7	21 43·6	"
0·23 S.— " 22	8	22	3	" 7	21 37·0	"
7·00 W.— " 20	8	22	3	" 8	21 44·6	"
0·16 S.— " 24	8	22	3	" 10	21 41·9	"
0·21 N.— " 23	8	22	3	" 10	21 39·0	"
0·23 S.— " 8	8	22	3	" 12	21 40·5	"
0·10 W.— " 7	8	22	3	" 18	21 40·9	"
5·00 W.— " 9	8	22	3	" 19	21 40·0	"
0·34 S.— " 10	8	22	3	" 19	21 39·5	"
0·30 S.— " 11	8	22	3	" 20	21 38·9	"
At ¼ post—E. by sec. 33	53	22	3	" 19	24 37·8	R. C. Purser.
40·00 E.—NE. cor. sec. 7	14	23	3	Sept. 27	22 06·8	C. Rinfret.
35·00 N.— " 11	15	23	3	" 24	22 14·9	"
0·35 W.— " 11	6	24	3	June 25	20 37·5	S. L. Evans.
8·00 W.— " 10	6	24	3	" 25	20 16·1	"
50·00 W.— " 9	6	24	3	" 25	19 58·0	"
7·00 W.— " 22	6	24	3	July 2	20 46·5	"
0·50 S.— " 9	6	24	3	" 6	19 53·5	"
23·00 W.— " 8	6	24	3	Aug. 12	20 07·0	"
2·03 S.— " 7	6	24	3	" 12	20 24·1	"
20·00 W.— " 22	15	24	3	Sept. 14	22 01·0	C. Rinfret.
10·00 W.— " 11	6	25	3	Aug. 6	21 44·2	S. L. Evans.
0·50 W.— " 10	6	25	3	" 6	22 22·3	"
1·00 S.— " 9	6	25	3	" 8	23 16·9	"
8·00 N.— " 20	6	25	3	" 9	23 08·0	"
0·50 S.— " 7	6	25	3	" 26	23 07·2	"
0·50 E.— " 8	6	25	3	" 26	23 15·7	"
0·60 W.— " 21	6	25	3	" 26	23 21·7	"
20·00 E.— " 36	13	25	3	" 27	22 33·1	C. Rinfret.
50·00 S.— " 30	53	25	3	" 7	24 22·7	G. J. Lonergan.
0·25 E.— " 32	5	26	3	" 21	22 27·2	S. L. Evans.
2·00 E.— " 9	6	26	3	" 15	22 18·8	"
" " 9	6	26	3	" 15	22 20·5	"
0·15 W.— " 33	6	26	3	" 21	22 39·2	"
0·30 W.— " 21	6	26	3	" 24	22 16·9	"
9·50 S.— " 22	6	26	3	" 29	22 24·1	"
15·00 N.— " 14	6	26	3	" 30	22 33·9	"
At NE. cor. sec. 33	37	26	3	" 19	22 36·5	R. C. Purser.
57·00 S.—NE. cor. sec. 14	6	27	3	Sept. 4	21 52·4	S. L. Evans.
0·60 W.— " 8	7	28	3	" 11	21 50·5	"
5·00 E.— " 7	7	28	3	" 9	21 57·0	"
0·25 E.— " 9	7	28	3	" 11	21 49·0	"
0·60 E.— " 11	7	28	3	" 2	21 42·0	"
0·40 N.— " 10	7	28	3	" 12	21 44·4	"
25·00 S.—54° 34′ E. of ¼ post on E. by sec. 21	6	1	4	June 16	21 48·4	E.S.Martindale.
152·50 E.—NE. cor. sec. 1	63	1	4	July 3	25 58·0	C. F. Miles.
48·18 N.— " 13	106	1	4	Sept. 26	30 38·1	J.B. McFarlane.

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
55·95 N.—NE. cor. sec. 36	108	1	4	July 18	30 27·8	J.B. Mc Farlane.
16·72 N.— " 1	109	1	4	" 19	30 37·8	"
58·02 N.— " 1	109	1	4	" 20	30 35·4	"
67·41 N.— " 25	109	1	4	" 24	30 34·6	"
5·02 N.— " 36	110	1	4	Aug. 6	30 30·6	"
61·74 N.— " 25	111	1	4	" 12	30 22·2	"
4·00 N.— " 25	112	1	4	" 21	32 21·8	"
27·25 N.— " 24	113	1	4	" 27	32 22·9	"
67·59 N.— " 36	114	1	4	Sept. 7	32 50·7	"
11·04 N.— " 1	115	1	4	" 11	32 57·5	"
11·04 N.— " 1	115	1	4	" 13	32 58·2	"
At NE. cor. sec. 16	6	2	4	June 1	21 47·6	E.S. Martindale
Centre sec. 24	8	3	4	Aug. 15	22 09·1	F. V. Seibert.
" 24	8	3	4	" 16	22 06·9	"
" 24	8	3	4	" 17	22 04·5	"
15·00 S.—NE. cor. sec. 10	17	3	4	July 18	23 08·7	G. C. Cowper.
20·00 E.— " 10	17	3	4	" 23	23 10·9	"
20·00 E.— " 10	17	3	4	" 28	23 12·9	"
10·00 E.— " 33	18	3	4	Aug. 4	23 16·5	"
5·00 N.— " 20	18	3	4	" 8	23 17·5	"
10·00 W.— " 20	18	3	4	" 19	23 16·9	"
10·00 E.— " 33	18	3	4	" 24	23 20·5	"
15·00 W.— " 11	19	3	4	July 7	23 20·9	"
At NE. cor. sec. 10	19	3	4	" 7	23 11·7	"
20·00 N.—NE. cor. sec. 16	17	4	4	Sept. 1	23 18·8	"
1·00 E.— " 33	19	4	4	June 5	23 10·3	"
10·00 S.— " 33	19	4	4	" 10	23 13·6	"
42·36 W.— " 31	92	5	4	Oct. 26	29 49·0	J.B. McFarlane.
69·10 W.— " 32	92	5	4	" 27	30 16·2	"
10·00 W.— " 36	1	6	4	June 2	21 54·5	C. M. Walker.
At NE. cor. sec. 8	1	6	4	" 16	22 06·5	"
" " 3	1	6	4	" 23	22 16·7	"
60·00 S.—NE. cor. sec. 1	1	6	4	" 26	22 15·3	"
25·00 N.— " 25	2	6	4	May 24	22 00·7	"
5·00 S.— " 23	2	6	4	" 28	22 08·3	"
18·00 N.— " 8	2	6	4	" 29	22 06·7	"
At NE. cor. sec. 33	2	6	4	" 24	22 22·8	"
59·93 W.—NE. cor. sec. 35	72	7	4	April 6	27 26·4	G. H. Blanchet.
78·22 W.— " 32	72	8	4	" 14	28 01·6	"
30·23 W.— " 33	72	9	4	" 20	27 33·7	"
31·34 N.— " 11	22	10	4	Sept. 22	23 35·5	G. C. Cowper.
" " 11	22	10	4	" 23	23 33·8	"
5·20 W.— " 31	72	10	4	April 29	27 59·4	G. H. Blanchet.
32·43 W.— " 36	76	10	4	May 29	30 14·5	G. McMillan.
At NE. cor, sec. 11	38	11	4	Aug. 30	25 08·7	F. V. Seibert.
40·00 S.—NE. cor. sec. 11	38	11	4	Sept. 2	24 59·8	"
16·01 W.— " 31	72	11	4	May 2	28 19·4	G. H. Blanchet.
25·99 W.— " 32	76	11	4	June 6	30 36·0	G. McMillan.
At NE. cor. sec. 13	24	12	4	Sept. 11	24 28·8	F. V. Seibert.
23·86 W.—NE. cor. sec. 34	72	12	4	May 7	28 02·5	G. H. Blanchet.
77·06 W.— " 36	72	13	4	" 9	28 24·2	"
64·17 W.— " 36	76	13	4	June 16	30 48·9	G. McMillan.
54·35 W.— " 31	76	13	4	" 23	30 18·5	"
At NE. cor. sec. 35	26	14	4	Sept. 10	23 53·2	F. V. Seibert.
3·00 E.—NE. cor. sec. 35	26	14	4	" 11	23 59·8	"
31·06 W.— " 36	72	14	4	May 14	28 37·6	G. H. Blanchet.
45·73 W.— " 36	76	14	4	June 21	30 06·6	G. McMillan.
At SE. cor. sec. 2	27	15	4	Sept. 10	24 19·1	F. V. Seibert.
7·10 W.—NE. cor. sec. 34	72	15	4	May 22	29 05·3	G. H. Blanchet.
46·78 W.— " 33	76	15	4	July 8	28 11·8	G. McMillan.
7·60 W.— " 32	72	16	4	June 1	28 33·5	G. H. Blanchet.
36·68 W.— " 31	76	16	4	July 20	29 34·4	G. McMillan.
28·00 N.— " 8	5	17	4	June 1	22 57·6	P. B. Street.
23·00 N.— " 10	5	17	4	" 6	23 00·2	"
71·33 W.— " 35	72	17	4	" 5	28 45·9	G. H. Blanchet.
38·95 W.— " 33	76	17	4	July 29	29 44·0	G. McMillan.
48·99 W.— " 33	88	17	4	Jan. 3	30 53·3	G. H. Blanchet.
2·00 N.— " 23	5	18	4	June 12	23 04·2	P. B. Street.
10·44 W. 19·69 S.—NE. cor. sec. 33	72	18	4	" 12	28 59·6	G. H. Blanchet.
48·69 W.—NE. cor. sec. 31	72	18	4	" 17	28 56·3	"
71·44 W.— " 36	76	18	4	Aug. 1	29 26·7	G. McMillan.

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
38·88 W.—NE. cor. sec. 31	76	18	4	Aug. 13	29 12·8	G. Mc Millan
11·49 W.— " 32	88	18	4	Jan. 15	30 44·9	G. H. Blanchet.
20·00 S.— " 24	2	19	4	June 20	22 21·2	P. B. Street.
W.— " 36	72	19	4	" 18	29 02·2	G. H. Blanchet.
60·30 W.— " 32	72	19	4	" 23	29 10·5	"
68·29 W.— " 35	76	19	4	Aug. 17	28 56·5	G. McMillan.
52·89 W.— " 31	88	19	4	Jan. 25	30 42·4	G. H. Blanchet.
14·30 W.— " 32	72	20	4	June 29	28 45·9	"
55·20 W.— " 32	76	20	4	Sept. 6	28 41·3	G. McMillan.
52·41 W.— " 32	88	20	4	Jan. 31	30 19·4	G. H. Blanchet.
13·78 W.— " 36	72	21	4	July 2	28 34·8	"
1·22 W.— " 32	76	21	4	Sept. 11	29 06·7	G. McMillan.
0·86 W.— " 31	88	21	4	Feb. 7	27 50·3	G. H. Blanchet.
At NE. cor. sec. 6	49	22	4	Oct. 17	26 44·2	F. V. Seibert.
" " 6	49	22	4	" 24	26 28·1	"
78·14 W.—NE. cor. sec. 36	76	22	4	Sept. 17	29 09·5	G. McMillan.
55·64 W.— " 32	76	22	4	" 24	28 36·8	"
22·00 W.— " 34	88	22	4	Feb. 9	27 24·4	G. H. Blanchet.
78·00 W.— " 32	72	23	4	July 18	28 36·2	"
26·35 W.— " 33	76	23	4	Sept. 30	28 50·4	G. McMillan.
1·00 W.— " 35	88	23	4	Feb. 13	29 53·3	G. H. Blanchet.
71·10 W.— " 35	72	24	4	July 20	29 09·8	"
64·42 W.— " 32	76	24	4	Oct. 9	29 36·0	G. McMillan.
65·00 W.— " 34	88	24	4	Feb. 20	30 30·2	G. H. Blanchet.
17·05 W.— " 33	72	25	4	July 29	29 05·2	"
19·04 W.— " 32	76	25	4	Oct. 16	29 01·7	G. McMillan.
At NE. cor. sec. 34	88	25	4	Mar. 4	30 19·4	G. H. Blanchet.
18·60 W.—NE. cor. sec. 34	72	26	4	Aug. 6	28 46·2	"
18·00 W.— " 34	76	26	4	Oct. 26	29 12·1	G. McMillan.
30·00 N.— " 27	50	28	4	Nov. 12	27 16·3	R. C. Purser.
NE. Bk. 7—Villa lots, SW. ¼ sec. 26	1	30	4	Sept. 16	21 50·4	F. V. Seibert.
16·76 S.—NE. cor. sec. 13	24	1	5	" 11	25 22·4	J. A. Fletcher.
" " 13	24	1	5	" 12	25 22·8	"
At NE. cor. sec. 25	50	1	5	Aug. 13	27 02·8	R. C. Purser.
60·75 W.—NE. cor. sec. 35	88	1	5	April 10	31 07·4	A. H. Hawkins.
At NE. cor. sec. 31	88	1	5	" 15	30 35·0	"
38·00 N.—NE. cor. sec. 35	11	2	5	Nov. 4	24 11·1	P. B. Street.
2·00 N.— " 28	11	2	5	" 20	24 09·2	"
8·00 S.— " 21	12	2	5	Dec. 4	24 13·8	"
28·00 S.— " 34	12	2	5	" 12	24 05·8	"
44·64 W.— " 36	88	2	5	April 16	30 49·0	A. H. Hawkins.
52·06 W.— " 31	88	2	5	" 17	31 11·5	"
44·00 W.— " 33	88	2	5	" 18	30 17·3	"
44·00 W.— " 33	88	2	5	" 19	30 12·2	"
51·00 E.— " 19	10	3	5	Oct. 10	24 00·9	P. B. Street.
10·00 E.— " 10	11	3	5	" 21	23 53·8	"
42·00 S.— " 9	12	3	5	July 26	24 01·2	"
In SE. ¼ sec. 6	12	3	5	" 28	23 49·9	"
53·88 W.—NE. cor. sec. 34	88	3	5	April 23	29 48·0	A. H. Hawkins.
40·82 W.— " 33	88	3	5	" 25	31 00·4	"
7·89 W— " 31	88	3	5	" 27	30 51·3	"
25·00 N.— " 7	11	4	5	Sept. 27	23 36·9	P. B. Street.
68·00 S.— " 20	19	4	5	Nov. 5	24 56·2	S. L. Evans.
60·00 W.— " 32	63	4	5	Oct. 5	29 02·5	G. J. Lonergan.
37·71 W.— " 35	88	4	5	April 30	32 00·8	A. H. Hawkins.
26·00 W.— " 34	88	4	5	May 1	31 09·4	"
7·01 W.— " 32	88	4	5	" 3	29 56·6	"
43·00 S.— " 11	12	5	5	Aug. 25	24 06·9	P. B. Street.
37·00 N.— " 2	13	5	5	" 12	24 04·5	"
12·00 S.— " 25	19	5	5	Oct. 13	25 01·8	S. L. Evans.
43·00 N.— " 12	19	5	5	Nov. 15	25 07·6	"
56·78 S.— " 36	20	5	5	Oct. 2	25 05·6	"
60·00 E.— " 22	64	5	5	" 3	28 30·0	G. J. Lonergan.
11·00 W.— " 36	88	5	5	May 4	31 26·2	A. H. Hawkins.
11·94 W.— " 33	88	5	5	" 6	30 31·8	"
10·88 W.— " 32	88	5	5	" 7	31 32·1	"
72·61 W.— " 31	88	5	5	" 9	31 44·2	"
5·00 W.— " 36	16	6	5	Nov. 18	25 03·5	E.S.Martindale.
20·00 N.— " 24	20	6	5	Oct. 14	25 15·4	S. L. Evans.
20·00 N.— " 24	20	6	5	" 14	25 05·4	"
40·00 S.— " 34	42	6	5	" 30	27 07·7	G. J. Lonergan.

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
12·83 W.—NE. cor. sec. 33	88	6	5	May 13	32 51·5	A. H. Hawkins.
74·03 W.— " 33	88	6	5	" 14	31 56·9	"
43·89 W.— " 31	88	6	5	" 15	31 14·3	"
15·00 S.— " 34	41	7	5	Nov. 4	26 57·6	G. J. Lonergan.
At NE. cor. sec. 35	41	7	5	" 4	26 56·4	"
5·00 W.—NE. cor. sec. 34	41	7	5	" 4	26 57·3	"
1·76 W.—NE. cor. sec. 34	88	7	5	May 21	30 39·0	A. H. Hawkins.
" " 34	88	7	5	" 22	30 29·8	"
57·28 W.— " 33	88	7	5	" 23	30 30·0	"
22·76 W.— " 36	88	8	5	" 28	29 59·9	"
0·91 W.— " 34	88	8	5	" 29	29 18·6	"
0·91 W.— " 34	88	8	5	" 30	29 10·8	"
79·56 W.— " 33	88	8	5	" 31	29 06·9	"
32·47 W.— " 36	88	9	5	June 3	28 33·5	"
0·43 W.— " 33	88	9	5	" 5	30 16·3	"
40·57 W.— " 33	88	9	5	" 7	29 49·5	"
68·85 W.— " 31	88	9	5	" 15	29 44·3	"
40·72 W.— " 36	88	10	5	" 17	29 41·0	"
14·71 W.— " 35	88	10	5	" 18	29 44·2	"
23·96 W.— " 34	88	10	5	" 19	29 42·6	"
0·80 W.— " 33	88	10	5	" 20	29 39·4	"
28·20 W.— " 36	88	11	5	" 24	28 50·8	"
17·88 W.— " 35	88	11	5	" 25	28 35·4	"
40·52 W.— " 32	88	11	5	" 29	29 38·7	"
12·60 N.— " 36	88	12	5	Jan. 5	28 41·1	L. E. Fontaine.
16·34 W.— " 36	88	12	5	July 1	29 23·8	A. H. Hawkins.
5·48 W.— " 35	88	12	5	" 3	28 55·9	"
39·68 W.— " 34	88	12	5	" 4	28 42·3	"
59·10 W.— " 33	88	12	5	" 5	28 34·2	"
71·94 W.— " 36	88	13	5	" 10	28 55·4	"
76·00 W.— " 34	88	13	5	" 11	28 58·5	"
4·28 W.— " 33	88	13	5	" 12	29 27·7	"
64·30 W.— " 31	88	13	5	" 15	28 50·0	"
7·88 N.— " 35	48	14	5	Jan. 19	27 13·4	L. E. Fontaine.
37·32 W.— " 36	88	14	5	July 16	28 59·3	A. H. Hawkins.
0·42 W.— " 33	88	14	5	" 22	30 04·5	"
42·50 W.— " 32	88	14	5	" 23	29 44·2	"
20·59 S.— " 36	49	15	5	Jan. 24	27 39·0	L. E. Fontaine.
3·17 S.— " 4	51	15	5	" 31	27 43·1	"
18·62 W.— " 36	88	15	5	July 24	30 56·4	A. H. Hawkins.
5·34 W.— " 32	88	15	5	" 27	31 04·0	"
At NE. cor. sec. 31	48	16	5	Dec. 7	27 35·7	H. Matheson.
38·00 S.—NE. cor. sec. 31	48	16	5	" 13	27 28·5	"
20·00 W.— " 19	48	16	5	" 15	27 29·2	"
30·00 S.— " 8	49	16	5	" 5	27 35·3	"
36·00 S.— " 4	49	16	5	" 4	27 31·6	"
30·00 E.— " 7	49	16	5	" 6	27 40·1	"
4·00 N.— " 6	49	16	5	" 7	27 33·5	"
30·00 W.— " 35	49	16	5	Oct. 15	27 46·1	"
At NE. cor. sec. 35	49	16	5	" 16	27 55·0	"
45·00 S.—NE. cor. sec. 26	49	16	5	" 30	27 55·0	"
42·50 E.— " 23	49	16	5	" 31	27 52·7	"
28·00 W.— " 23	49	16	5	Nov. 1	27 54·7	"
At NE. cor. sec. 34	49	16	5	" 2	27 49·3	"
14·00 N.—NE. cor. sec. 27	49	16	5	" 2	27 52·9	"
38·00 N.— " 22	49	16	5	" 7	27 48·2	"
30·00 N.— " 15	49	16	5	" 13	27 45·1	"
35·00 N.— " 10	49	16	5	" 18	27 41·5	"
2·00 N.— " 14	49	16	5	" 20	27 44·6	"
At NE. cor. sec. 11	49	16	5	" 20	27 37·0	"
27·00 E.—NE. cor. sec. 11	49	16	5	" 21	27 36·2	"
38·00 E.— " 10	49	16	5	" 22	27 36·6	"
30·00 N.— " 9	49	16	5	" 26	27 39·7	"
36·00 N.— " 16	49	16	5	" 28	27 45·1	"
20·00 W.— " 9	49	16	5	" 29	27 39·6	"
30·00 S.— " 2	50	16	5	Oct. 18	27 49·4	"
20·00 S.— " 11	50	16	5	" 21	27 50·2	"
38·00 E.— " 11	50	16	5	" 22	27 53·2	"
18·00 E.— " 10	50	16	5	" 28	27 42·9	"
48·29 W.— " 35	88	16	5	Aug. 1	31 33·3	A. H. Hawkins.
At NE. cor. sec. 29	28	17	5	June 29	24 28·1	N. C. Stewart.

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
30·00 S.—NE. cor. sec. 34	48	17	5	Dec. 26	27 34·8	H. Matheson.
6·00 N.— " 26	48	17	5	" 21	27 31·2	"
16·00 S.— " 1	49	17	5	" 10	27 34·2	"
9·00 N.— " 1	49	17	5	" 11	27 39·1	"
47·02 W.— " 36	88	17	5	Aug. 6	31 06·0	A. H. Hawkins.
5·70 W.— " 34	88	17	5	" 7	31 03·0	"
20·70 W.— " 31	88	17	5	" 10	31 06·7	"
16·05 S.— " 32	49	18	5	July 4	28 28·0	L. E. Fontaine.
62·50 W.— " 32	88	18	5	Aug. 19	25 21·6	A. H. Hawkins.
52·00 S.— " 36	50	19	5	July 9	28 03·4	L. E. Fontaine.
73·07 W.— " 35	88	19	5	Aug. 21	31 45·3	A. H. Hawkins.
42·96 W.— " 33	88	19	5	" 22	31 31·5	"
21·19 W.— " 31	88	19	5	" 23	31 23·7	"
0·85 N.— " 34	50	20	5	May 21	28 16·2	L. E. Fontaine.
8·10 S.— " 9	56	20	5	June 5	29 01·5	"
72·70 N.— " 7	83	20	5	Aug. 8	29 58·6	"
15·96 W.— " 35	88	20	5	" 26	31 03·2	A. H. Hawkins.
25·08 W.— " 31	88	20	5	Sept. 2	31 04·4	"
65·75 N.— " 22	49	21	5	May 3	28 04·1	L. E. Fontaine.
2·05 N.— " 12	50	21	5	" 8	28 04·7	"
6·65 S.— " 22	56	21	5	June 9	29 24·4	"
50·80 N.— " 36	81	21	5	Aug. 5	29 49·7	"
41·89 W.— " 35	88	21	5	Sept. 4	31 23·4	A. H. Hawkins.
19·16 W.— " 34	88	21	5	" 5	31 11·3	"
60·78 W.— " 34	88	21	5	" 6	31 23·2	"
10·00 N.—SE. cor. sec. 10	28	22	5	July 4	25 59·7	N. C. Stewart.
At NE. cor. sec. 10	28	22	5	" 8	26 05·9	"
50·00 N.—SE. cor. sec. 15	28	22	5	" 10	26 09·6	"
40·00 N.— " 22	28	22	5	" 17	26 12·8	"
At NE. cor. sec. 11	28	22	5	" 18	26 18·0	"
20·00 N.—SE. cor. sec. 29	28	22	5	" 22	25 42·8	"
At NE. cor. sec. 35	28	22	5	" 23	26 46·7	"
" " 33	28	22	5	" 29	26 15·2	"
20·00 W.—NE. cor. sec. 36	28	22	5	Aug. 1	26 15·0	"
At NE. cor. sec. 31	28	22	5	" 7	26 11·4	"
" " 32	28	22	5	" 8	26 19·1	"
73·00 S.—NE. cor. sec. 32	28	22	5	" 9	26 16·8	"
At NE. cor. sec. 6	29	22	5	Nov. 5	25 49·5	"
57·00 W.—NE. cor. sec. 6	29	22	5	" 6	26 00·6	"
37·35 S.— " 21	71	22	5	" 1	29 50·7	L. E. Fontaine.
38·80 N.— " 6	84	22	5	Aug. 13	31 51·7	"
At NE. cor. sec. 36	88	22	5	Sept. 10	31 43·1	A. H. Hawkins.
69·35 W.—NE. cor. sec. 36	88	22	5	" 11	31 40·7	"
16·36 W.— " 32	88	22	5	" 13	31 49·5	"
33·00 N.—SE. " 1	29	23	5	Nov. 7	26 22·0	N. C. Stewart.
27·00 N.—NE. " 1	29	23	5	" 8	26 14·9	"
3·00 W.— " 12	29	23	5	" 9	26 09·5	"
At NE. cor. sec. 11	29	23	5	" 14	26 19·0	"
25·00 S.—NE. cor.—NW. ¼ sec. 23	29	23	5	" 18	26 23·5	"
6·00 E.—NE. cor. sec. 22	29	23	5	" 20	26 15·9	"
Course 3—2 Traverse of Is. N. in sec. 11	29	23	5	" 25	26 19·0	"
30·00 W.—NE. cor. sec. 10	29	23	5	" 29	26 13·9	"
" " 10	29	23	5	" 30	26 22·2	"
" " 10	29	23	5	Dec. 3	26 24·7	"
0·05 N.— " 24	70	23	5	Oct. 26	29 56·2	L. E. Fontaine.
11·37 N.— " 3	84	23	5	Aug. 16	31 48·8	"
59·54 W.— " 35	88	23	5	Sept. 19	32 05·9	A. H. Hawkins.
6·32 S.— " 3	71	24	5	Oct. 18	29 22·1	L. E. Fontaine.
0·23 N.— " 11	84	24	5	Aug. 21	30 57·6	"
75·59 W.— " 35	88	24	5	Sept. 27	32 07·6	A. H. Hawkins.
2·94 W.— " 32	88	24	5	" 28	32 00·0	"
19·85 W.— " 31	88	24	5	Oct. 3	31 44·6	"
At NE. cor. sec. 18	31	25	5	Sept. 9	26 11·0	N. C. Stewart.
12·00 W.—NE. cor. sec. 19	31	25	5	" 10	26 18·7	"
27·15 S.— " 24	69	25	5	Oct. 24	29 08·4	L. E. Fontaine.
64·85 N.— " 23	70	25	5	" 15	29 06·8	"
32·46 W.— " 35	88	25	5	" 4	32 06·1	A. H. Hawkins.
At NE. cor. sec. 32	31	26	5	Aug. 14	26 15·4	N. C. Stewart.
46·00 W.—NE. cor. sec. 32	31	26	5	" 20	26 09·3	"
42·00 N.— " 31	31	26	5	" 22	26 09·8	"
2·00 N.— " 5	32	26	5	" 15	26 16·5	"

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date	Declination.	Observer.
30·00 N.—NE. cor. sec. 6	32	26	5	Aug. 23	26 30·4	N. C. Stewart.
30·00 N.— " 7	32	26	5	" 26	26 26·6	"
18·00 E.—NW. " 30	32	26	5	" 31	26 37·0	"
8·00 E.—NE. " 30	32	26	5	Sept. 2	26 37·0	"
18·00 E.— " 30	32	26	5	" 3	26 37·0	"
40·50 E.— " 30	32	26	5	" 3	26 26·9	"
63·00 E.— " 30	32	26	5	" 5	26 16·7	"
6·00 E.—NW. " 30	32	26	5	Aug. 29	26 47·7	"
41·73 N.—NE. c r. sec. 13	48	1	6	Aug. 22	27 32·2	J. A. Fletcher.
" " 13	48	1	6	" 22	27 39·2	"
" " 13	48	1	6	" 22	27 40·5	"
7·67 N.—SE. " 36	86	1	6	Oct. 18	31 53·0	J. R. Akins.
16·70 S.—NE. " 13	86	1	6	" 19	31 42·4	"
36·67 S.— " 1	86	1	6	" 21	31 37·4	"
32·90 E.— " 32	88	1	6	" 1	32 29·2	"
55·00 E.— " 33	88	1	6	" 1	32 27·8	"
17·16 E.— " 36	88	1	6	" 3	32 08·4	"
56·69 S.— " 34	88	1	6	" 14	32 21·8	"
58·53 N.— " 25	89	1	6	" 17	32 33·6	A. H. Hawkins.
64·47 N.— " 13	89	1	6	" 15	32 21·6	"
45·03 N.— " 24	89	1	6	" 16	32 27·2	"
6·81 N.— " 12	90	1	6	" 21	32 38·5	"
20·13 N.— " 24	90	1	6	" 22	31 41·9	"
0·47 N.— " 36	90	1	6	" 23	32 47·7	"
36·72 S.— " 33	84	2	6	Sept. 6	31 34·0	L. E. Fontaine.
5·84 N.— " 16	85	2	6	" 4	31 32·8	"
12·50 W.— " 31	88	2	6	" 20	33 06·7	J. R. Akins.
29·92 E.— " 33	88	2	6	" 24	33 05·3	"
6·11 E.— " 34	88	2	6	" 25	33 02·2	"
65·80 N.— " 33	83	3	6	Aug. 28	31 36·2	L. E. Fontaine.
3·32 N.— " 2	85	3	6	Sept. 1	31 30·9	"
38·59 W.— " 32	88	3	6	" 14	33 58·2	J. R. Akins.
5·51 W.— " 32	88	3	6	" 16	33 14·6	"
10·66 E.— " 36	88	3	6	" 19	33 08·9	"
64·38 S.— " 23	81	4	6	" 13	30 21·1	L. E. Fontaine.
24·19 E.—NW. " 32	88	4	6	" 5	32 12·0	J. R. Akins.
33·14 E.—NE. " 32	88	4	6	" 7	32 25·3	"
36·18 E.— " 33	88	4	6	" 9	32 27·3	"
16·34 W.— " 35	88	4	6	" 11	32 33·7	"
66·50 W.— " 36	84	5	6	Nov. 1	29 22·5	"
58·73 W.— " 34	84	5	6	" 2	29 23·9	"
11·48 N.— " 12	85	5	6	" 18	30 08·4	"
12·75 N.— " 24	85	5	6	" 20	30 33·1	"
66·81 N.— " 24	85	5	6	" 22	30 36·3	"
46·07 N.— " 36	86	5	6	" 23	31 00·6	"
17·20 N.— " 12	86	5	6	" 25	31 21·6	"
66·62 N.— " 12	86	5	6	" 26	31 27·4	"
6·48 N.— " 36	86	5	6	" 27	31 34·2	"
40·39 W.— " 31	88	5	6	Aug. 29	31 48·5	"
2·50 W.— " 31	88	5	6	" 29	31 51·6	"
28·96 E.— " 32	88	5	6	" 30	31 42·4	"
62·78 E.— " 33	88	5	6	" 31	31 48·8	"
4·55 W.— " 35	88	5	6	Sept. 2	31 49·4	"
3·23 E.— " 36	88	5	6	" 2	31 43·1	"
15·31 E.— " 36	88	5	6	" 4	32 04·0	"
17·00 S.— " 7	19	6	6	" 15	26 18·7	"
6·96 N.— " 23	74	6	6	" 19	29 10·8	L. E. Fontaine.
2·08 N.— " 23	75	6	6	" 27	29 48·3	"
0·41 S.— " 13	75	6	6	" 29	30 27·2	"
40·47 W.— " 36	84	6	6	Nov. 6	29 52·7	J. R. Akins.
3·14 W.— " 34	84	6	6	" 7	30 26·3	"
3·78 W.— " 33	84	6	6	" 8	30 59·3	"
At NE. cor. sec. 32	84	6	6	" 9	30 57·6	"
74·04 N.—NE. cor. sec. 1	85	6	6	Dec. 2	30 08·8	"
43·72 W.— " 31	88	6	6	Aug. 14	32 02·7	"
65·25 E.— " 31	88	6	6	" 15	32 01·7	"
28·40 W.— " 34	88	6	6	" 17	31 35·3	"
46·43 E.— " 35	88	6	6	" 28	31 40·4	"
40·30 S.— " 32	18	7	6	May 28	25 20·2	N. C. Stewart.
2·00 N.—SE. " 30	18	7	6	" 30	26 04·1	"
34·00 N.— " 6	19	7	6	" 31	26 31·6	"

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer	Date.	Declination.	Observer.
4·75 S.—NE. cor. sec. 7	19	7	6	June 3	26 00·6	N. C' Stewart.
26·16 W.— " 32	88	7	6	Aug. 6	30 54·1	J. R. Akins.
39·35 E.— " 32	88	7	6	" 9	31 08·5	"
22·26 E.— " 35	88	7	6	" 13	31 51·4	"
5·00 N.— " 10	18	8	6	June 6	26 12·0	N. C. Stewart.
At NE. cor. sec. 11	18	8	6	" 10	25 18·1	"
At SE. " 2	18	8	6	" 14	25 31·1	"
At NE. " 15	18	8	6	Oct. 25	25 40·2	"
At NE. " 10	20	8	6	" 29	26 04·3	"
8·00 W.—NE. cor. SE. ¼ sec. 15	20	8	6	" 30	26 03·6	"
24·00 N.—NE. cor. SW. ¼ sec. 15	20	8	6	" 31	26 01·4	"
33·38 N.—NE. cor. sec. 27	74	8	6	" 5	30 13·9	L. E. Fontaine.
10·34 S.— " 12	75	8	6	" 5	30 00·3	"
39·76 E.— " 33	88	8	6	July 31	30 34·9	J. R. Akins.
" " 33	88	8	6	Aug. 1	30 35·4	"
38·07 E.— " 35	88	8	6	" 3	30 35·3	"
At NE. cor. sec. 22	19	9	6	" 26	24 57·0	M.P.Bridgland.
17·80 N.—NE. cor. sec. 15	19	9	6	Oct. 2	25 51·9	J. A. Fletcher.
" " 15	19	9	6	" 3	25 52·1	"
44·00 N.—SW. " 6	19	9	6	" 5	25 36·3	N. C. Stewart.
22·00 N.— " 7	19	9	6	" 7	25 43·9	"
52·00 N.— " 7	19	9	6	" 8	25 33·3	"
50·00 W.—NE. " 7	19	9	6	" 9	25 48·0	"
9·00 N.—SW. " 18	19	9	6	" 10	25 36·4	"
51·00 N.— " 18	19	9	6	" 11	25 30·6	"
30·00 N.—SE. " 19	19	9	6	" 15	25 25·7	"
3·50 N.— " 30	19	9	6	" 18	25 24·5	"
46·00 N.—NE. " 19	19	9	6	" 21	25 42·5	"
25·00 S.— " 31	19	9	6	" 23	25 36·7	"
12·00 N.—N. by sec. 6—W. by Okanagan I.R. No. 1	17	10	6	Sept. 26	25 29·0	"
Cor. of Jog—W. by Okanagan I.R. No. 1—Sec. 8	17	10	6	" 27	25 29·7	"
At NE. cor. sec. 32	19	10	6	Oct. 2	25 43·7	M.P. Bridgland.
" " 32	19	10	6	" 2	25 45·9	"
1·50 N. 54° 33′ E. of NE. end of base line at Salmon Arm	20	10	6	May 10	25 42·9	J. A. Fletcher.
1·50 N. 54° 33′ E. of NE. end of base line at Salmon Arm	20	10	6	" 10	25 42·6	"
1·50 N. 54° 33′ E. of NE. end of base line at Salmon Arm	20	10	6	" 11	25 39·2	"
1·50 N. 54° 33′ E. of NE. end of base line at Salmon Arm	20	10	6	" 11	25 37·3	"
1·50 N. 54° 33′ E. of NE. end of base line at Salmon Arm	20	10	6	" 13	25 43·1	"
1·50 N. 54° 33′ E. of NE. end of base line at Salmon Arm	20	10	6	" 13	25 42·5	"
1·50 N. 54° 33′ E. of NE. end of base line at Salmon Arm	20	10	6	" 14	25 44·1	"
1·50 N. 54° 33′ E. of NE. end of base line at Salmon Arm	20	10	6	" 15	25 43·1	"
1·50 N. 54° 33′ E. of NE. end of base line at Salmon Arm	20	10	6	" 16	25 43·8	"
1·50 N. 54° 33′ E. of NE. end of base line at Salmon Arm	20	10	6	" 17	25 44·4	"
37·00 S.—NE. cor. sec. 9	20	10	6	" 17	25 52·2	M.P. Bridgland.
" " 9	20	10	6	" 17	25 57·2	"
At NE. cor. sec. 9	20	10	6	June 9	25 57·8	"
" " 9	20	10	6	Nov. 6	25 54·3	"
" " 10	20	10	6	" 6	25 47·0	"
" " 5	20	10	6	" 6	26 07·7	"
40·25 S.—NE. cor. sec. 5	20	10	6	" 6	25 49·5	"
" " 5	20	10	6	Oct. 2	25 47·8	"
At NE. cor. sec. 4	20	10	6	Nov. 6	25 44·9	"
40·00 N.—NE. cor. sec. 29	23	14	6	Sept. 19	26 13·4	C. H. Taggart.
81·14 E.—NE. cor. S. ½ sec. 6	24	14	6	" 22	26 05·8	"
" " 6	24	14	6	" 22	26 13·2	"
" " 6	24	14	6	" 22	26 12·6	"
" " 6	24	14	6	" 22	26 09·5	"
" " 6	24	14	6	" 22	26 09·5	"
" " 6	24	14	6	" 22	26 06·4	"

MAGNETIC DECLINATION.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
81.14 E.—NE. cor. S½ sec. 6	24	14	6	Sept. 22	26 12·6	C. H. Taggart.
" " 6	24	14	6	" 22	26 06·6	"
" " 6	24	14	6	" 22	26 10·7	"
" " 6	24	14	6	" 22	26 13·5	"
60·25 N.—NE. cor. sec. 8	24	14	6	" 28	25 57·9	"
60·00 N.— " 20	24	14	6	Oct. 5	26 17·4	"
10·00 N.— " 27	20	15	6	" 31	30 05·1	"
40·00 E.— " 34	20	15	6	" 30	29 26·3	"
At NE. cor. sec. 29	20	15	6	Nov. 4	27 52·9	"
40·25 E.—NW. cor. sec. 18	23	15	6	July 31	25 24·0	"
65·25 S.—NE. " 11	24	15	6	Aug. 29	26 48·5	"
45·00 N.— " 3	24	15	6	" 19	25 40·3	"
48·00 E.— " 4	22	16	6	June 5	26 58·5	"
70·00 N.— " 3	22	16	6	" 20	26 50·6	"
54·00 N.— " 12	23	16	6	July 30	25 54·1	"
At NE. cor. sec. 3	26	16	6	" 26	25 49·3	"
4·50 E.—NE. cor. sec. 22	21	17	6	May 7	26 00·4	"
30·00 S.— " 23	21	17	6	" 7	26 15·1	"
40·00 W.— " 15	21	17	6	" 17	26 12·2	"
34·00 S.— " 28	21	17	6	" 18	26 26·2	"
20·00 S.— " 21	21	17	6	" 20	25 43·6	"
40·00 E.— " 23	22	17	6	" 29	26 32·6	"
1·00 W.— " 14	22	17	6	" 30	27 09·9	"
50·00 E.— " 15	18	18	6	Dec. 4	26 07·0	"
35·00 N.— " 23	18	18	6	" 6	26 02·5	"
At NE. cor. sec. 21	18	18	6	" 7	26 01·3	"
10·00 N.—NE. cor. sec. 10	18	18	6	" 12	26 18·0	"
31·57 W.—NE. cor. sec. 34	76	18	6	April 6	30 18·6	J. R. Akins.
66·92 W.— " 32	76	18	6	" 15	30 10·9	"
21·00 N.— " 21	84	18	6	May 10	31 40·3	L. Brenot.
20·00 N.— " 1	84	18	6	June 5	31 20·7	"
0·70 W.— " 35	76	19	6	April 18	29 58·2	J. R. Akins.
4·78 W.— " 35	76	19	6	" 18	29 56·8	"
26·43 W.— " 34	76	19	6	" 19	29 54·4	"
79·70 W.— " 34	76	19	6	" 20	29 52·8	"
47·84 W.— " 33	76	19	6	" 23	29 52·9	"
77·01 W.— " 32	76	19	6	" 24	29 50·8	"
77·01 W.— " 32	76	19	6	" 24	29 50·5	"
40·00 S.— " 36	83	19	6	July 31	31 47·8	L. Brenot.
At NE. cor. sec. 8	84	19	6	April 16	31 12·5	"
20·00 N.—NE. cor. sec. 24	84	19	6	" 22	31 32·5	"
11·00 S.— " 2	84	19	6	July 1	31 24·0	"
25·35 W.— " 36	76	20	6	April 25	29 56·9	J. R. Akins.
64·75 W.— " 31	76	20	6	May 6	30 22·4	"
48·00 W.— " 18	20	21	6	Dec. 13	25 14·5	J. A. Calder.
At NE. cor. sec. 36	76	21	6	May 7	30 30·2	J. R. Akins.
58·08 W.—NE. cor. sec. 36	76	21	6	" 8	30 32·8	"
50·38 W.— " 34	76	21	6	" 13	30 29·6	"
5·80 W.— " 33	76	21	6	" 14	30 36·9	"
13·28 W.— " 32	76	21	6	" 15	30 37·8	"
65·70 W.— " 31	76	21	6	" 20	30 44·5	"
0·50 W.— " 31	76	21	6	" 18	30 40·4	"
6·00 N.— " 24	20	22	6	Dec. 7	26 12·0	J. A. Calder.
30·73 W.— " 36	76	22	6	May 21	30 49·4	J. R. Akins.
58·53 W.— " 36	76	22	6	" 22	30 44·2	"
7·20 W.— " 34	76	22	6	" 24	30 47·9	"
9·03 W.— " 33	76	22	6	" 25	30 53·4	"
0·58 W.— " 32	76	22	6	" 27	31 03·1	"
17·90 W.— " 32	76	22	6	" 28	31 01·2	"
17·90 W.— " 32	76	22	6	" 29	31 03·8	"
73·31 W.— " 31	76	22	6	" 31	31 07·6	"
64·00 E.— " 32	83	22	6	Oct. 27	31 53·2	L. Brenot.
16·08 E.— " 1	14	23	6	Aug. 9	24 51·8	J. A. Calder.
5·00 W.— " 35	20	23	6	Nov. 29	27 26·8	"
40·26 W.— " 36	76	23	6	June 1	31 16·9	J. R. Akins.
23·30 W.— " 34	76	23	6	" 4	31 26·6	"
16·16 W.— " 32	76	23	6	" 7	31 24·3	"
At NE. cor. sec. 12	84	23	6	Oct. 24	32 01·4	L. Brenot.
7·60 S.—¼ on E. by sec. 29	16	24	6	June 22	26 45·3	J. A. Calder.
48·18 W.—NE. cor. sec. 35	76	24	6	" 12	31 12·5	J. R. Akins.
57·37 W.— " 34	76	24	6	" 13	31 07·7	"

MAGNETIC DECLINATION.—*Continued*

Place.	Tp.	Rge.	Mer.	Date.	Declination.	Observer.
9·62 W.—NE. cor. sec. 33	76	24	6	June 15	31 01·9	J. R. Akins.
78·70 W.— " 33	76	24	6	" 17	31 04·3	"
31·57 W.— " 31	76	24	6	" 20	30 55·4	"
29·00 W.— " 33	16	25	6	July 10	25 04·2	J. A. Calder.
Sta. 27 Traverse left bank Thompson river	16	25	6	" 18	27 19·7	"
NW. cor. of Oregon Jack, I. R. No. 1	19	25	6	Dec. 18	26 05·7	"
17·19 W.—NE. cor. sec. 36	76	25	6	June 22	31 05·6	J. R. Akins.
41·44 W.— " 33	76	25	6	" 24	31 02·5	"
60·08 W.— " 31	76	25	6	" 29	31 17·9	"
8·00 N.— " 18	81	25	6	Sept. 17	31 24·8	L. Brenot.
Yola Cr. Traverse Sta. 73 Sec. 10	3	26	6	July 8	24 17·5	A. Lighthall.
About 15·00 NW.—¼ post N. by Sec. 13	3	26	6	" 27	25 14·2	"
20·50 SW.—SE. cor. T. B. 554, Bk. 2	4	26	6	Aug. 13	25 18·6	"
20·49 S.—NW. cor. T. B. 554, Bk. 2	4	26	6	" 14	25 37·5	"
9·55 E.—NE. cor. sec. 2	4	26	6	Nov. 19	23 57·4	"
At NE. cor. sec. SW. ¼ sec. 5	5	26	6	June 10	25 32·1	"
21·53 E.—NE. cor. sec. 35	7	26	6	Sept. 30	25 38·8	P. Melhuish.
55·13 W.—Centre sec. 26	8	26	6	May 24	25 58·6	"
52·00 E.—¼ post E. by sec. 22	8	26	6	June 1	26 19·2	"
74·70 S.—NE. cor. sec. 23	8	26	6	" 4	26 59·9	"
35·00 S.— " 14	8	26	6	" 5	28 05·5	"
At NE. cor. sec. 11	8	26	6	" 6	26 07·5	"
3·15 W.—NE. cor. sec. 1	8	26	6	" 18	25 16·3	"
20·02 S.— " 33	10	26	6	Nov. 7	25 57·9	"
43·00 S.— " 28	10	26	6	" 14	26 12·2	"
5·00 E.— " 21	10	26	6	" 15	26 11·4	"
3·00 N.—¼ cor.—N. by sec. 22	10	26	6	" 16	26 17·1	"
30·75 W.—NE. cor. sec. 28	11	26	6	Oct. 15	26 38·2	"
70·00 W.— " 28	11	26	6	" 16	26 09·6	"
30·00 N.— " 27	11	26	6	" 18	26 17·9	"
25·00 N.—¼ cor. N. by sec. 23	11	26	6	" 30	25 57·9	"
18·27 S.—NE. cor. sec. 15	11	26	6	" 4	25 55·1	"
51·46 S.— " 15	11	26	6	" 5	25 44·9	"
At NE. cor. sec. 15	11	26	6	" 7	25 50·5	"
2·60 N.—¼ cor.—N. by sec. 15	11	26	6	" 8	25 53·2	"
3·55 W.—Centre sec. 22	11	26	6	" 9	25 59·5	"
4·82 E.—¼ cor.—E. by sec. 21	11	26	6	" 10	26 05·2	"
14·97 S.—NE. cor. sec. 21	11	26	6	" 11	26 15·4	"
34·21 N.— " 21	11	26	6	" 12	26 10·5	"
At NE. cor. sec. 28	11	26	6	" 14	25 27·8	"
10·00 W.—NE. cor. lot 1471	15	26	6	" 27	26 20·1	J. A. Calder.
Centre sec. 10	16	26	6	Nov. 13	25 54·6	"
9·70 W.—NE. cor. sec. 35	76	26	6	July 2	31 15·1	J. R. Akins.
10·00 N.— " 13	81	26	6	Aug. 30	31 21·2	L. Brenot.
70·25 E.—NW. " 31	4	27	6	Nov. 6	24 20·2	A. Lighthall.
37·72 E.— " 30	4	27	6	" 15	24 04·7	"
63·29 N.—NE. " 24	12	27	6	" 25	26 09·1	P. Melhuish.
20·00 E.— " 25	12	27	6	" 27	25 39·8	"
65·00 E.— " 25	12	27	6	" 28	25 55·2	"
Sta. 66 Traverse right bank Stein river	15	27	6	Aug. 28	26 17·9	J. A. Calder.
28·00 E.—NW. cor. sec. 9	4	28	6	Dec. 6	26 15·0	A. Lighthall.
15·00 E.—NE. " 29	15	28	6	Sept. 12	26 11·4	J. A. Calder.
8·00 E.— " 34	15	29	6	Oct. 9	25 54·3	"
10·00 E.— " 15	6	5	7	" 1	26 01·5	A. Lighthall.
10·00 S.— " 29	6	5	7	Sept. 19	25 27·7	"
4·00 E.—NW. " 2	6	7	7	Aug. 21	26 34·0	"
5·00 W.—NE. " 12	6	7	7	Sept. 4	25 50·2	"
5·00 S.— " 20	19	.....	F.C.	Oct. 12	24 57·5	"

MAGNETIC DIP AND TOTAL INTENSITY.

Place.	Tp.	Rge.	Mer.	Date.	Time.	Dip.	Time.	Total Intensity. c.g.s.	Observer.
40·00 W. 10·00 S.—NE. cor. sec. 18	40	22	3	14–10–10	9.03 A	77 26·8	9.30 A	·62752	D. E. Chartrand.
" "	40	22	3	14–10–10	9.58 A	77 26·3	10.25 A	·62773	"
10·00 S. 15·00 E.—¼ p. W. by 31	37	24	3	23–10–10	1.57 P	77 15·2	2.27 P	·62519	"
" "	37	24	3	23–10–10	2.54 P	77 13·9	3.19 P	·62563	"
5·00 S.—¼ p. E. by sec. 9	21	4	2	15– 6–10	3.30 P	77 42·8	4.10 P	·63169	"
" "	21	4	2	15– 6–10	4·45 P	77 39·7	5.25 P	·63164	"
" "	21	4	2	15– 6–10	5.57 P	77 41·5	.....	.....	"
" "	21	4	2	19– 6–10	8.47 A	77 43·5	9.30 A	·63176	"
" "	21	4	2	19– 6–10	10·07 A	77 43·0	10.40 A	·63171	"
" "	21	4	2	19– 6–10	11.15 A	77 43·6	.....	.....	"
30·00 W. 10·00 S.—NE. cor. sec. 3	35	1	3	31– 7–10	9.18 A	77 34·5	9·51 A	·63488	"
20·00 S. 3·00 E.—NE. cor. sec. 12	34	3	3	3– 8–10	1.45 P	77 38·9	2.27 P	·63364	"
" "	34	3	3	3– 8–10	3.07 P	77 39·8	3.35 P	·63359	"
22·00 N. 35·00 W.—SE. cor. sec. 9	33	4	3	10– 8–10	2.24 P	77 19·7	3.09 P	·63179	"
15·00 N. 14·00 W.—NE. cor. sec. 36	38	5	3	12– 8–10	2.21 P	77 52·1	2.56 P	·62991	"
" " 36	38	5	3	12– 8–10	3.34 P	77 53·2	4.09 P	·63004	"
At NE. cor. sec. 29	22	6	2	9– 6–10	2.46 P	77 48·8	3.39 P	·63061	"
" "	22	6	2	9– 6–10	4.24 P	77 48·5	4.54 P	·63122	"
" "	22	6	2	9– 6–10	5.24 P	77 50·3	.....	.....	"
" "	22	6	2	12– 6–10	9.49 A	77 49·9	10.36 A	·63103	"
" "	22	6	2	12– 6–10	11.16 A	77 50·5	11.54 A	·63167	"
" "	22	6	2	12– 6–10	12.24 P	77 50·7	.....	.....	"
22·00 N. 35·00 W.—SE. cor. sec. 9	33	4	3	9–10–10	9.39 A	77 21·6	10.06 A	·63103	"
" "	33	4	3	9–10–10	10.39 A	77 22·3	11.09 A	·63104	"
5·00 N. 25·00 W.—NE. cor. sec. 22	32	16	2	17– 7–10	9.25 A	78 15·6	10·00 A	·63355	"
" "	32	16	2	17– 7–10	10.28 A	78 16·1	10·58 A	·63238	"
" "	32	16	2	17– 7–10	11.30 A	78 15·8	.....	.....	"
10·00 W.—Centre sec. 36	32	20	2	27– 7–10	7.13 P	78 03·4	7.43 P	·63304	"
30·00 W.—NE. cor. sec. 3	35	1	3	30– 7–10	4.36 P	77 35·7	5.01 P	·63551	"
" "	35	1	3	30– 7–10	5.31 P	77 33·0	5.58 P	·63587	"
" "	35	1	3	30– 7–10	6.36 P	77 33·4	.....	.....	"
At NE. cor. sec. 8	26	12	2	6– 7–10	2.15 P	77 53·1	2.47 P	·63163	"
" "	26	12	2	6– 7–10	3.20 P	77 53·7	4.00 P	·63138	"
" "	26	12	2	6– 7–10	4.30 P	77 54·3	.....	.....	"
3·00 E. of. NE. cor. sec. 22	33	22	2	16– 7–10	1.30 P	78 01·0	2.02 P	·63286	"
" "	33	22	2	16– 7–10	2.30 P	78 02·6	2.55 P	·63215	"
" "	33	22	2	16– 7–10	3.25 P	78 02·1	.....	.....	"
20·00 N.—NE. cor. sec. 17	36	27	Pr.	31– 5–10	3.05 P	79 05·2	3.52 P	·63924	"
" "	36	27	Pr.	31– 5–10	4.47 P	79 04·7	.....	.....	"
" "	36	27	Pr.	1– 6–10	9.25 A	79 10·8	10.17 A	·63872	"
" "	36	27	Pr.	1– 6–10	11.00 A	79 10·3	.....	.....	"

20·00 N—NE. cor. sec. 17	36	27	Pr.	3– 6–10	1.05 P	79	05·9	1.42 P	·63915	D. E. Chartrand.
" " "	36	27	Pr.	3– 6–10	2.25 P	79	05·9	2.57 P	·63921	"
" " "	36	27	Pr.	3– 6–10	3.32 P	79	06·1	.....	.....	"
5·00 N. 15·00 E.—¼ E. by 29	45	21	2	1– 9–10	9.20 A	79	01·1	10.00 A	·63019	"
" " "	45	21	2	1– 9–10	10.35 A	79	04·3	11·10 A	·62993	"
20·00 S.—SE. cor. sec 5	49	26	2	3– 9–10	1.57 P	79	13·5	2.32 P	·63381	"
" " "	49	26	2	3– 9–10	3.00 P	79	12·9	3.30 P	·63441	"
At ¼ post W. by sec. 30	43	16	3	12– 9–10	11·24 A	77	42·3	12.00 M	·62755	"
" "	43	16	3	12– 9–10	12.32 P	77	42·3	1.12 P	·62752	"
20·00 S. 20·00 E.—NW. cor. sec. 7	45	18	2	6–10–10	9.49 A	79	03·2	10.22 A	·63142	"
" "	45	18	2	6–10–10	10.54 A	79	03·0	11.27 A	·63205	"
15·00 W.—NE. cor. sec. 18	48	25	3	25– 9–10	9.36 A	78	18·5	10.11 A	·62744	"
" "	48	25	3	25– 9–10	10.48 A	78	20·2	11.26 A	·62742	"
10·00 S. 10·00 E.—¼ P.W. by 6	39	2	3	29– 9–10	8.10 A	78	15·2	8.40 A	·63393	"
" "	39	2	3	29– 9–10	9.12 A	78	14·8	9.52 A	·63537	"
20·00 S.—SE. cor. sec. 5	49	26	2	1–10–10	10.07 A	79	13·3	10.39 A	·63447	"
" "	49	26	2	1–10–10	11.09 A	79	15·3	11.37 A	·63394	"
10·00 S. 5·00 E.—NE. cor. 19	37	22	2	18– 8–10	8.45 A	78	28·7	9.20 A	·63292	"
" "	37	22	2	18– 8–10	9.52 A	78	29·6	10.25 A	·63297	"
30·00 S. 5·00 E.—NE. cor. 34	42	3	3	23– 8–10	8.25 A	78	14·6	9.02 A	·63695	"
" "	42	3	3	23– 8–10	9.47 A	78	15·3	10.27 A	·63666	"
At NE. cor. sec. 12	49	4	3	27– 8–10	9.44 A	78	45·1	10.24 A	·62920	"
" "	49	4	3	27– 8–10	10.59 A	78	45·4	11.31 A	·62964	"
Churchill East Peninsula—Lat 58° 47′ 34″, long. 94° 10′ 00″	.....	.....	.....	23– 8–08	11.48 A	84	38·0	12.44 P	·63740	J. E. Morrier.
	.....	.....	.....	23– 8–08	3.11 P	84	36·8	11.32 A	.....	"
" " " "	.....	.....	.....	30– 8–08	11.32 A	84	41·3	12.34 P	·63567	"
" " " "	.....	.....	.....	30– 8–08	3.48 P	84	34·1	4.27 P	·63593	"
Churchill West Peninsula—Lat. 58° 46′ 47″, long. 94° 11′ 00″	.....	.....	.....	22– 9–08	10.55 A	84	33·5	11.55 A	·64007	"
" " " "	.....	.....	.....	22– 9–08	2.05 P	84	35·1	2.50 P	·63681	"
" " " "	.....	.....	.....	1–11–08	11.20 A	84	35·4	12.17 P	·63987	"
" " " "	.....	.....	.....	1–11–08	1.00 P	84	36·9	1.36 P	·63876	"
H. B. Post, Norway House—Lat. 53° 58′ 00″, long. 97° 52′ 00″	.....	.....	.....	18– 6–08	10.44 A	80	58·9	12.01 P	·63876	"
	.....	.....	.....	18– 6–08	1.35 P	80	58·2	2.28 P	·63769	"
" " " "	.....	.....	.....	21– 6–08	10.14 A	80	58·0	11.14 A	·63887	"
	.....	.....	.....	21– 6–08	1.38 P	80	57·1	2.22 P	·63978	"
H. B. Post, Oxford House—Lat. 54° 53′ 30″, long. 95° 45′ 00″	.....	.....	.....	27– 6–08	12.12 P	82	31·6	12.57 P	·64218	"
	.....	.....	.....	27– 6–08	2.19 P	82	31·9	2.54 P	·64093	"
H. B. Post, York Factory—Lat. 57° 00′ 00″, long. 92° 28′ 00″	.....	.....	.....	7– 7–08	4.48 P	83	32·9	5.35 P	·63234	"
	.....	.....	.....	8– 7–08	9.52 A	83	27·4	10.24 A	·63413	"
" " " "	.....	.....	.....	8– 7–08	2.24 P	83	27·0	.....	.....	"
" " " "	.....	.....	.....	8– 7–08	5.20 P	83	30·9	5.57 P	·63486	"
" " " "	.....	.....	.....	10– 7–08	9.04 A	83	27·5	9.46 A	·63539	"
" " " "	.....	.....	.....	10– 7–08	10.40 A	83	36·3	11.12 A	·63200	"
71·11 N. 71·01 E.—NE. cor. sec. 7	66	22	4	19– 5–10	10.40 A	78	04·5	11.24 A	·62146	Carl Engler.
" "	66	22	4	19– 5–10	12.10 P	78	03·1	.....	.....	"
" "	66	22	4	20– 5–10	2.32 P	78	04·3	3.27 P	·62137	"
" "	66	22	4	20– 5–10	3.44 P	78	00·6	.....	.....	"
Grand Rapids, Athabaska river	84	17	4	31– 5–10	10.04 A	79	28·5	11.18 A	·62259	J. A. Cote.
" "	84	17	4	31– 5–10	12.42 P	79	28·6	.....	.....	"
" "	84	17	4	1– 6–10	9.30 A	79	27·3	10·21 A	·62217	Carl Engler.
" "	84	17	4	1– 6–10	11.06 A	79	26·8	.....	.....	"

MAGNETIC DIP AND TOTAL INTENSITY.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Time.	Dip.	Time.	Total Intensity. c.g.s.	Observer.
Below Boiler Rapids, Athabaska river	.....	.....	.....	5– 6–10	5.57 P	79 31·2	6.32 P	·62913	Carl Engler.
Big Cascade, Athabaska river	.....	.....	.....	7– 6–10	4.22 P	79 39·1	5.00 P	·62372	J. A. Cote.
" "	.....	.....	.....	7– 6–10	5.32 P	79 42·9	.....	.....	"
Fort McMurray, S. shore Athabaska river, opp. island	.....	.....	.....	10– 6–10	3.22 P	79 58·1	4.00 P	·62700	"
" " " "	.....	.....	.....	10– 6–10	4.24 P	79 57·7	.....	.....	Carl Engler.
" " " "	.....	.....	.....	13– 6–10	2.11 P	80 00·1	3.00 P	·62566	"
" " " "	.....	.....	.....	13– 6–10	3.39 P	79 58·1	.....	.....	"
Fort Chipewyan	.....	.....	.....	17– 6–10	3.33 P	81 08·2	4.03 P	·62588	J. A. Cote.
Smith Landing, SW. cor. H. B. Co. Res	.....	.....	.....	23– 6–10	3.42 P	81 55·0	4.20 P	·65489	"
" "	.....	.....	.....	23– 6–10	4.54 P	81 49·4	.....	.....	Carl Engler.
Ft. Smith, near Observing Tent	.....	.....	.....	11– 7–10	4.20 P	81 57·3	5.05 P	·62259	J. A. Cote.
" "	.....	.....	.....	12– 7–10	3.27 P	81 57·9	4.16 P	·62153	"
" "	.....	.....	.....	12– 7–10	4.55 P	81 59·0	.....	.....	"
Fort Chipewyan	.....	.....	.....	6– 8–10	10.43 A	81 09·7	12·24 P	·62391	Carl Engler.
"	.....	.....	.....	6– 8–10	1.20 P	81 09·2	.....	.....	"
Ft. McMurray, Point of Mag. Observations	.....	.....	.....	10– 8–10	9.19 A	80 02·8	10.09 A	·62547	"
" " "	.....	.....	.....	10– 8–10	10.49 A	80 00·1	.....	.....	"
Grand Rapids, E. shore of river	.....	.....	.....	24– 8–10	10.15 A	79 28·5	10.52 A	·62134	"
" "	.....	.....	.....	24– 8–10	11.22 A	79 29·6	.....	.....	"

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